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Index to Advertisers—Page xl.

Principal Contents:

	PAGE
Contractors and Development	411
Distribution in the West Midlands	414
The "Single-phasing" Trouble. By M. V. Russell	416
Thermal Storage Systems. By E. M. Ackery	417
Ceramic Materials for Electrical Purposes	418
Greenhouse and Soil Heating. By T. D. Oswald	419
The Contractors' Dinner	420
Feed-water Regulation. By V. Walker	421
Canvassing the Builder. By A. V. Cross	422
Meetings and Discussions	423
Correspondence: High-voltage Cable Development; Professional Incomes; Cables Across the Andes; Automatic Cooker Control	425
The Broadcasting Committee's Report	426
New Apparatus and Devices	427
British Overseas Electrical Trade	429
Legal and Parliamentary	430
Business and Industrial Notes	431
Electricity Supply	435
Traction and Communications	436
Contract Information	438
Notes	439
Our Personal Column	440
Financial Section	441
Published Specifications	445
New Work for Contractors	446

Contractors and Development

THIS year the annual dinner of the Electrical Contractors' Association was held much later than usual on account of the national mourning. Perhaps we may attribute the brighter note which characterised the speeches delivered on Tuesday to this fact and to the consequent touch of spring in the air contrasting so happily with the usual chilling blasts of January.

At some earlier dinners we have suspected the contractors of an inferiority complex, or persecution mania. They have imagined that every man's hand was against them, working for their utter elimination. But this year they were evidently in a mood of optimistic self-reliance, ready to challenge the world in an endeavour to demonstrate their indispensability to electrical development.

They are not without some justification for this confident attitude, for is it not true that, in spite of municipal competition, "jerry" wiremen, ironmongers and other bugbears, on which speakers at previous dinners have dwelt long and earnestly, they still survive and, what is more, are prospering?

Mr. Bruty (the president) was bold enough to claim that if the contractors were forced to go out of business electrical development would come to a sudden stop. Of course, nobody believes that he meant this literally, but we *can* believe that development would be seriously retarded if the hundreds of enterprising contractors who are in constant touch with a very wide public were to cease their activities.

But why need such a possibility even be contemplated for a moment? There is no need for any trepidation on the part of organised contractors. Their good work is thoroughly recognised by the majority of supply authorities and the rulers of the industry. What is needed is the organisation of their efforts to make them even more indispensable and invaluable to electrical progress, and it was to this point, more particularly, that Mr. Bruty directed his attention.

He claimed that the Association already formed a means of bringing electricity into the homes of the nation. It had more than seventy branches, all active electrical circles, well qualified and prepared, with the assistance of the supply authorities, to do all that was necessary to educate the public and bring an ever-growing load to the grid.

A glowing picture was painted of the ultimate results of such a system guided by a power sales director and fed with sales ammunition from a central organisation, which sounded very much like the Electrical Development Association (as Mr. Bruty admitted). In fact, the system as a whole suggested to our minds E.D.A. as it was before reorganisation made its membership purely representative of electricity supply, leaving the way open for the other sections of the industry to co-operate somewhat loosely on a voluntary basis.

Can it be that there is present in the E.C.A. a desire to revert to the *status quo*, hoping and trusting that a new spirit will pervade the E.D.A.-like organisation and enable it to go ahead on the lines which at the time of reorganisation were not giving satisfaction? Do the contractors think that the reconstruction of E.D.A. was a mistake which should be recognised and corrected? Are they desirous of resuming their connection with the Association, giving it substantial financial and other support? For ourselves, however, we question whether Mr. Bruty visualised such a possibility—perhaps he wanted to see the positions of the supply authorities and contractors in the different areas reversed—E.C.A. Circles instead of E.D.A. Circles?

The Broadcasting Report

THE report of the Ullswater Committee on the Future of Broadcasting, which is reviewed in this issue, surveys a wide field, ranging from the private affairs of the B.B.C. staff to the financing of television. As was expected, the extension of the B.B.C.'s Charter is recommended, the period suggested being ten years. More and better-paid governors are proposed, and it is thought that the B.B.C.

should be allowed to retain more of the money which the public provides for its services. On the technical side the most far-reaching proposal is that the broadcast relay systems should be placed under public control. These systems are said to number 340 and to serve 200,000 subscribers, whose minds are likely to be poisoned by advertisements or betting news from foreign stations. The principal reason for public control, however, is an economic one—the possible extended use of the trunk telephone system. The Committee considers the average price of British receiving sets to be somewhat high, and advocates the following of the German idea of a cheap standardised receiver evolved by co-operation between the broadcasting authority and the wireless trade.

Individuality and Co-operation

THE plea for a closer association of the various branches of engineering advanced by Mr. H. N. Gresley, President of the Institution of Mechanical Engineers, at the dinner of the Junior Institution of Engineers last week received strong backing from its President, Sir Frank Smith, who pointed out that co-operation was not incompatible with individualism. Both speakers urged the advantages of a central home in London for the social as well as the technical aspects of engineering, thus reinforcing the views of Mr. J. D. Watson (President of the Institution of Civil Engineers), on which we commented on February 14th. Realisation of this ideal would no doubt do much to correct the tendency, on which Sir Arnold Wilson remarked, for engineers to become so absorbed in their special line of work as not to appreciate what was being done in other branches. To overcome that would be very much to the good, but the effects of a common lack of contact with the outside world, also deplored by Sir Arnold, would still remain to depreciate the value of the engineer's work and deprive it of its proper recognition by the general public.

Big Business

LAST year 17,565 million kWh of electricity was generated by authorised undertakings in Great Britain; the County of London Co. was responsible for about a tenth of this. The actual amount sold to its consumers was 885.4 million kWh, while the Central Electricity Board took 682.3 million—a total of 1,567.7 million, as compared with 1,050.8 million in 1934. If further figures are needed to show the magnitude of the concern, we may mention that the net capital expenditure stands at £20,095,447 6s. 3d. (to the nearest penny) and the maximum demand reached the figure of 353,856 kW. The company and its subsidiaries serve a wide area in London and the Home Counties, and development has been actively proceeding in some of the outlying parts—particularly in Essex. The rapidity of this development may be gauged from the fact that in two years the quantity of energy generated and purchased has more than doubled, including the Central Board's requirements. In spite of the fact that charges have been substantially lowered during the last year or two the company was able to maintain its ordinary dividend.

Fair Trading in America

WE seem to remember that the United States electrical industry drew up a "fair trade code" two or three years ago, but after a period of much trumpeting little more was heard of it. Now the *Electrical World* (New York) reports that the National Electrical Manufacturers' Association has called a conference of the industry, with the co-operation of the Federal Trade Commission, with a view to the adoption of a set of fair trade practice rules. "It is pointed out that it may prove advisable to draft rules for various sections of the industry, and that joining the movement is a matter of individual consent." So far as we can gather the trouble in the United States is in the retailing branch of the industry—considered apart from the electricity supply business. The "merchandising" activities of the power companies are a recognised part of the electrical business structure of the United States; it is "bootlegging" by smaller retailers which creates the need for a code. The Americans' problem should, therefore, prove easier of solution than ours seems to be—and yet the "fade-out" of the earlier attempt suggests otherwise.

Neutral Inversion

DISPLACEMENT of the neutral point on a power system from causes other than earth faults is probably more common than is generally realised, and the abnormality may remain unsuspected until damage results from excessive voltage. The origin is usually an open circuit in one phase of a system possessing appreciable capacitance, but, as Mr. B. G. Gates points out in a contribution to the I.E.E. *Journal*, this condition is not essential. Thus neutral inversion may occur with transformers without a delta winding. Where it is required to earth the neutrals on both sides of a transformer the provision of one winding of the interconnected-star type will not prevent the displacement of the neutral of the other (star) winding, as was once generally believed, and a tertiary delta is called for. Another contingency to be guarded against is the inadvertent leaving of a bank of star-connected single-phase potential transformers in circuit to provide the only earth connection of a system. In one case, three times the voltage at double the supply frequency resulted from this, causing a generator (the neutral connection of which had been left open) and other apparatus connected to break down to earth.

A Tangled Skein

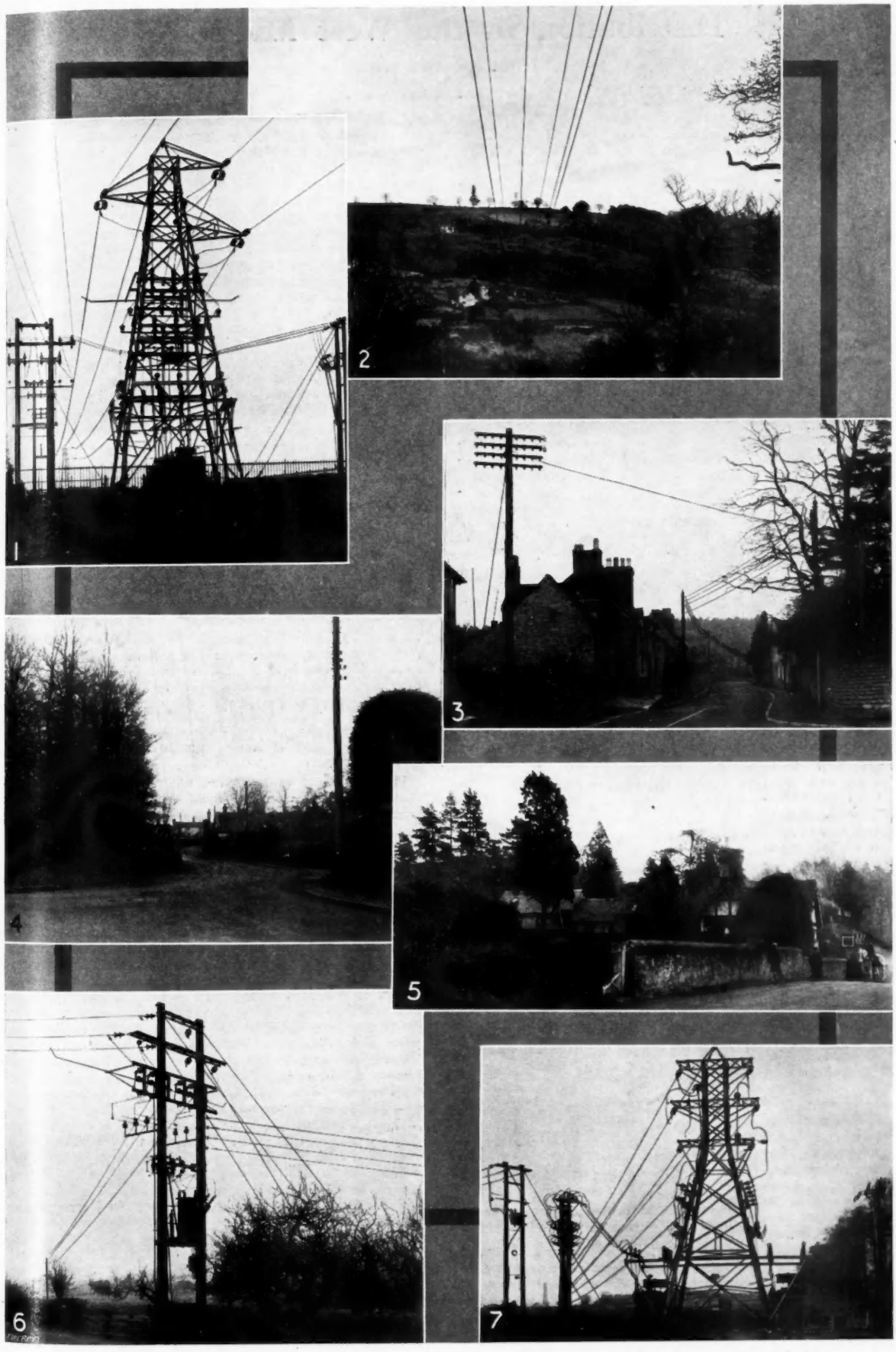
IN the House of Commons last week the Minister of Transport was asked if he would consider consolidating the law relating to electricity supply, and he promised to "bear the suggestion in mind." The questioner referred to eleven Acts, but actually there are thirteen and there is yet another upon the stocks—the Electricity Supply (Meters) Bill. Moreover, to be complete any codifying measure would have to embody parts of two earlier Acts—the Gasworks Clauses Acts of 1847 and 1871. It will be gathered that the combination of all these in one consolidating Act would be a colossal task, and in any case many of the measures deal with quite separate matters. There is, however, scope for clarification and the modernisation of the earlier Acts, and to this extent the suggestion is to be welcomed and might secure sympathetic consideration.

A Large Frequency Change-over

AN idea of the magnitude of the change of frequency work in the area of the North-Eastern Electric Supply Co. was given by Mr. R. P. Sloan in his chairman's address at the company's annual meeting on Tuesday last. Up to the end of last year no fewer than 31,000 motors, aggregating 712,000 h.p., had been changed, or more than ten times the h.p. of new connections in 1935. Under a revised arrangement with the C.E.B., Dunston "B" station becomes the property of the company. This station has been running for three years under dual frequency conditions, but even so it achieved a thermal efficiency of well over 25 per cent. in 1934. When frequency standardisation is completed the station will have a chance to rival the performances of other leading stations.

Broadcasting in Northern Ireland

THE Northern Ireland transmitting station of the B.B.C., which is to be opened to-day, is the highest power medium-wave station in the British Isles, and the 100-kW delivered to the aerial is the maximum permitted under the Lucerne scheme at 307 metres. The general circuit employed resembles that of the long-wave National transmitter at Droitwich, but the transmitter is in one large unit instead of several relatively small units. Radiation is effected horizontally from the 475-ft. "mast"-type aerial itself, no aerial wires being used; thus the "sky wave" will be minimised. This design should appreciably extend the range for non-fading reception.



Points of Interest in the West Midland J.E.A.'s Area. **(See page 414)**

1. The main 33/11-kV outdoor sub-station at Berrington. 2. A span of about 2,400 ft. comprising six 37/.062 s.c.a. conductors on steel towers. 3. Steel-pole l.p. distribution in Haughton Village. 4. Typical wood-pole l.p. village distribution. 5. L.p. overhead distribution in Leighton Village. All the premises are on the supply and the lines are completely hidden. 6. An 11-kV angle and sub-station tapping pole. 7. The Shifnal main sub-station with two 1,000-kVA, 33/11-kV transformers

Distribution in the West Midlands

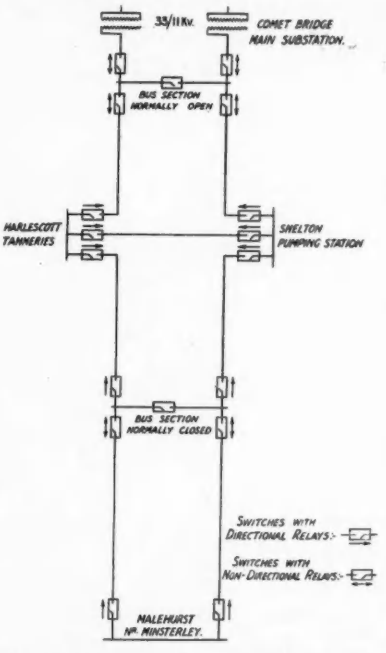
A tour of the J.E.A.'s area

SUFFICIENT advance has now been made in the development of electricity distribution by the West Midlands Joint Electricity Authority in its prescribed area to warrant the publication of a description of the scheme, and the following observations made during a tour of the heart of the area will serve to show the general character of the system. The Joint Authority's distribution area of about 450 square miles is very roughly that rectangular section of Shropshire with Newport, Melverley, Brompton and Worfield at its north-east, north-west, south-west, and south-east corners, respectively, and the route of the tour was approximately the circle *via* Shifnal, Newport, Shrewsbury and Ironbridge.

The Authority actually administers supplies in an area of approximately 1,000 square miles in Staffordshire and Shropshire, but the distribution in about one-half the area is in the hands of local authorities who purchase their energy in bulk from the J.E.A. The remaining area was not delimited until the Authority was formed as it was considered to be too sparsely populated to be likely to give economic results.

In 1930 the Authority decided to commence distributing in the area, and by the end of 1932 approximately £150,000 had been expended on the work, although up to that date only 500 domestic consumers had been obtained. In order to bring in the maximum amount of revenue it was decided to encourage to the utmost the industrial load which consists of a number of small works scattered throughout the area and certain small works which were situated in a formerly prosperous industrial area in and around Ironbridge, which is one of the first places in the world where iron was smelted by means of coal. A survey showed a total potential industrial demand of over 17 million kWh per annum, and 85 per cent. of this has now been obtained. Further, several new small industries are likely to become established in the area.

The Authority claims that from the known costs of private plant public supply has permitted of an annual saving of £10,000 in power costs to industrial consumers. The result of obtaining the power load has been that the Authority has been able to carry out wide extensions of mains costing about £250,000, and to obtain an annual revenue in the fifth year which is in excess of the total cost of giving supply. Efforts are now being concentrated upon the domestic load. During last year 1,000 additional consumers were obtained, making a total of 5,000 to date. The past year's operation resulted in a surplus of nearly £6,000, and it is anticipated that the surplus for the current year will probably eliminate the deficits of the first five years of operation.



Directional protection arrangements of the ring-main system from Comet Bridge

We actually commenced and finished our tour at Wolverhampton, eight or so miles east of the distribution area boundary, where, at the Authority's headquarters, we had a preliminary talk with Mr. E. F. Hetherington, M.I.E.E., chief engineer and manager, who stressed the fact that the scheme is designed to be self-supporting, without being subsidised from the generating side or in any other way. He also referred to the steel-tower double-circuit 33-kV lines radiating from the generating point at Ironbridge as the backbone of the system.

With our guide, Mr. J. A. Sumner, distribution engineer, who has been responsible to Mr. Hetherington for most of the design and erection work, we first made contact with this "backbone" at Shifnal, the terminal point of one leg of the steel-tower scheme. The other leg joins Ironbridge and Wellington, and there is also the original and similar supply line built for the constructional work at Ironbridge running south to Bridgnorth. By adopting 132-kV grid-type towers for the single-circuit 33-kV lines a saving of £300 per mile on the initial line cost was effected, and we should say that where these towers have become virtual sub-station structures the saving must have been very considerable. British Insulated Cables, Ltd., supplied and erected all the steel-tower lines. At present only one of the Ironbridge-Shifnal circuits is operated at 33 kV, the other being 11 kV.

The layout at Shifnal sub-station is such that one section of the isolator-split bus-bars is fed from the 33-kV circuit *via* an isolator, a fuse and a 1,000-kVA transformer, while the other section is similarly fed from the same line and also from the 11-kV line *via* an isolator and a fuse. Normally one 11-kV bus-bar section provides a feed north to the Newport area and the other south to Worfield, both *via* wood-pole lines. Local distribution is also provided from bus-bar sections through suitable transformers and switchgear.

On our way north from Shifnal we saw a good example of the Authority's standard method of tapping an 11-kV line for isolated l.p. supplies—in this case for three l.p. distribution lines. A 25-kVA transformer is mounted between the two members of the pole structure and is fed through a pull-down switch-fuse, the outward l.p. lines being supplied through an ironclad switch-fuse fixed to the near member. This tapping is, of course, on the line running north to Newport, but at the far end of the line at Lilleshall we saw one of the two feeding points for what is known as the Newport ring (11 kV). The other feed is at Newport and is by an extension of one of the circuits on the Ironbridge-Wellington steel-tower line.

The Lilleshall structure is four-member and it provides for the "in" and "out" ring connections, the 11-kV feed from Shifnal and two l.p. lines for local distribution. There is an isolator between the bus-bars and each of the three 11-kV lines, and an isolator and a switch-fuse between the bus-bars and the transformer on the connection for the l.p. feeds. There is also, within easy reach from the ground level, an ironclad switch-fuse in each of the l.p. circuits. Lilleshall is a very convenient switching point.

The Newport ring covers a rural area of about 40 square miles, and it is but one of a number of similar 11-kV ring-mains constructed about the "backbone" or, better still, about the primary 33-kV ring-main linking Ironbridge, Wellington and Shrewsbury.

During the run of about ten miles almost due west from Newport to Shrewsbury we passed through a rural area indeed which yielded nothing of notable electrical interest except the rather surprising pronouncement that within a year the area would be covered. At present the Authority is concentrating on development work in the south-west area; this is rather "thin," too, although there are some quarries.

The Shrewsbury Area

The Shrewsbury area is a fairly rich one in industry. Apart from supplying in bulk, the Authority is not concerned about distribution in the town proper, but it serves the outskirts of the town and the country around. One engineering works in this area moved from Lancashire eight years ago and established diesel plant for its electricity supply. But the public supply was adopted as soon as it became available four years later, with consequent saving in running costs.

With reference to the ring-main supplied from this sub-station a further outgoing feeder emanating from an intermediate sub-station at Shelton pumping station continues south, skirting the town of Shrewsbury, to Meole Brace sub-station; a further line to be erected in the near future from Meole Brace *via* Uffington to Harlescott will complete a second ring-main encircling the town of Shrewsbury. A third ring, which will be approximately 25 miles in length when completed, runs from Meole Brace to Hanwood, Pontesbury, and villages south of Shrewsbury, returning *via* Dorrington and Bayston Hill to Meole Brace. The whole of this system of ring mains, based on the main step-down sub-station at Comet Bridge, is fitted with directional protection, and will normally be run as a closed system.

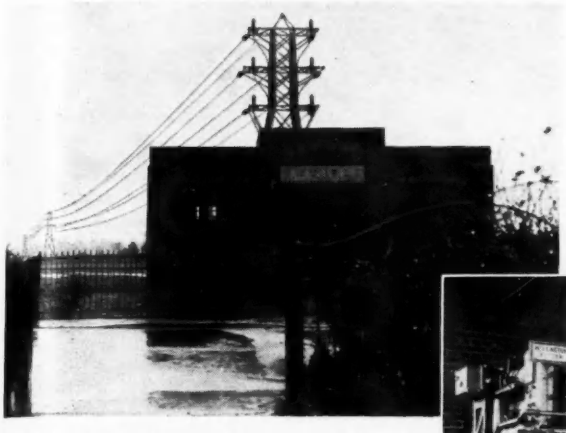
At the main supply point at Comet Bridge English Electric enclosed switchgear governs the two 33-kV ring-main connections, two transformers and a bus-bar coupler on the primary system, and two ring connections, two Shrewsbury bulk-supply feeders, two local supply transformers and a central bus-bar coupler on the 11-kV side.

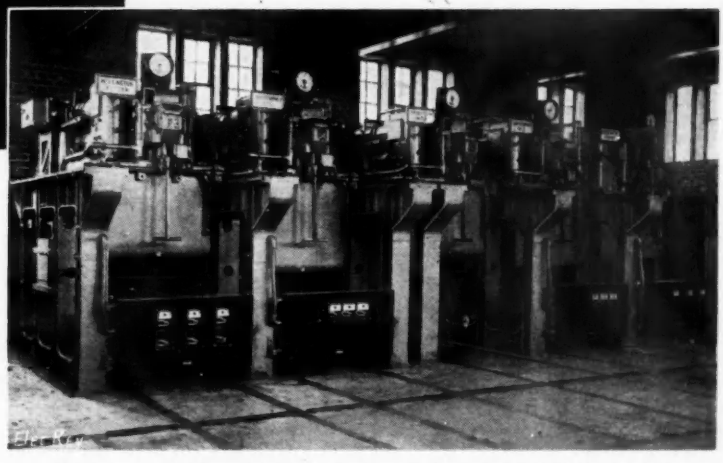
Another five miles south-east of Shrewsbury and we were at Cross Houses, where an important in-and-out break in the southern part of the 33-kV ring provides, through two 300-kVA transformers, three 11-kV feeds—one spur northward to Atcham and Attingham, a feed west to give a duplicate supply

to Bayston Hill, which will normally be supplied from the Minsterley ring, and a supply south-west to Berrington which will be continued to give a duplicate supply to Condover.

This Cross Houses sub-station is probably the best example on the system of a steel-tower sub-station layout. Bus-bars and fuses are arranged on opposite sides of the tower to the transformers at the base, and 11-kV equipment is similarly arranged on the other two sides of the tower. All told there are seven 200-A 11-kV switches at this point.

Leaton " sub " on the northern section of the primary ring is somewhat similar in arrangement to that at Cross Houses,





The Comet Bridge sub-station and a view of the 33-kV switchgear in that building

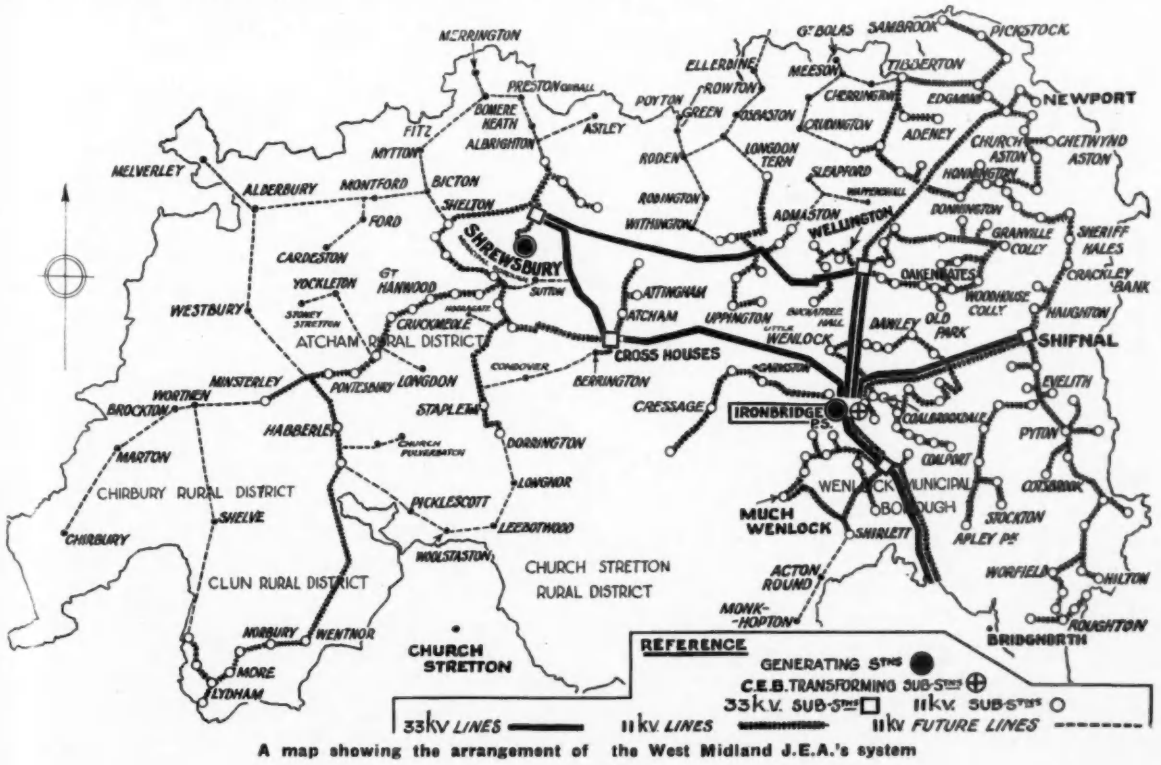
except that at the moment it is merely a tapping with just an isolator and a fuse link on the 33-kV side of a 150-kVA transformer which serves four 11-kV spurs. At Atcham and Leighton we saw the success of the Authority's efforts to preserve rural beauty.

Following the Severn on its north bank to Ironbridge we had an excellent view of the new power station there and on the other side of the river we saw the grid lines from Ocker Hill power station on the top and down the near slope of Benthall Edge.

Simplicity is the keynote of the Malcolm's Tower outgoing sub-station at Ironbridge because of the control gear for the 33-kV feeds within the power station. The underground mains from the station are directly connected to the Wellington circuits, and the Cross Houses links of the 33-kV ring and the 33-kV circuit of the Ironbridge-Shifnal line are direct tee-offs through isolators and switch-links with a secondary tee-off on the Shifnal connection for a 33-kV to 11-kV step-down which serves the 11-kV circuit on the Ironbridge-Shifnal line and a feed to Leighton and other villages to the West. At the other end of the Ironbridge-Wellington line the two 33-kV circuits feed through oil circuit-breakers a duplicate bus-bar arrangement, each circuit being connected through isolators to both sets of bus-bars. Similarly tee-offs from the two sets of bus-bars provide alternative feeds for the 33-kV link to Shrewsbury and two step-down transformers which supply the 11-kV system in the vicinity, consisting essentially of a small underground ring-main in Wellington proper and an overhead ring-main linking up several towns and collieries to the east.

There is within this last-mentioned ring-main a secondary inner ring of which part of the outer one is a component. Within the area of about ten square miles covered by these two combined rings there are as many as fifteen 11-kV sub-stations. We saw what is believed to be the longest span of line in this country, apart from the grid. It is in the Wellington-Shifnal steel-tower line and is 2,348 ft. long.

A little further east we saw the sub-station at Brockholes which is a loop in a ring a part of which is a section of the 11-kV circuit on the Ironbridge-Shifnal steel-tower line. By virtue of the same main-line connections the same section completes another ring on the other side of the main line *via* Dawley and Little Wenlock. From Broseley, a few miles south of Ironbridge, another fairly concentrated ring-main *via* Much Wenlock has both its feeds. In the low-pressure area between Ironbridge and Wellington about 5,000 consumers have been connected.



A map showing the arrangement of the West Midland J.E.A.'s system

The "Single-phasing" Trouble. By M. V. Russell

Protecting polyphase motors from the effects of open circuits

A COMMON cause of failure of polyphase motors is "single-phasing," *i.e.*, a motor may run as a single-phase machine if a fault develops in one of the phase windings inside it, or an open circuit occurs in one of the external lines. Such a condition may be due to several causes, *e.g.*, an overloaded or faulty soldered joint, a bad starter contact or the blowing of one of the main fuses, and the effect in each case is to increase the current in the two other lines. Under certain circumstances, this excess current may be sufficient to operate the normal type of overload relay and thereby disconnect the supply from the motor. This possibility, however, can be relied upon only when the motor normally operates at full load.

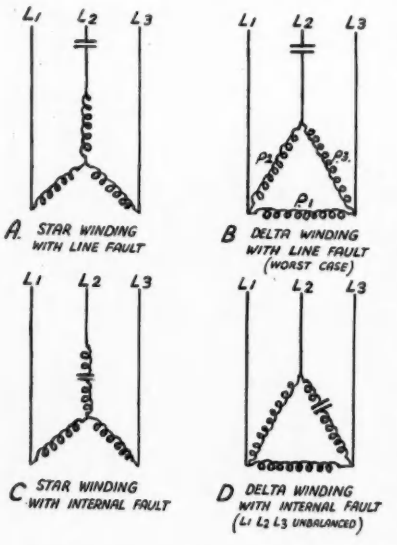

L1 L2 L3
A STAR WINDING WITH LINE FAULT
B DELTA WINDING WITH LINE FAULT (WORST CASE)
C STAR WINDING WITH INTERNAL FAULT
D DELTA WINDING WITH INTERNAL FAULT (L1 L2 L3 UNBALANCED)

Fig. 1.—Four conditions under which a three-phase motor may operate as single-phase

If the motor is developing only seventy-five per cent. of its rated output, the line current when single-phasing will increase by nearly fifty per cent. above the corresponding three-phase value, and this will be about twenty per cent. in excess of the *rated* three-phase current, so that if the overload relays were set to trip at twenty-five per cent. above the normal current, the motor would continue to run single-phase. While this is probably an advantage where continuity of operation is essential, it may have disastrous effects on the motor windings.

Should the current fail in one supply line when a motor is arranged for star-delta starting or is provided with a straight delta-connected winding, the current flowing into the stator along the remaining lines will generally divide unequally between its three windings, the one which is connected directly across the two live lines carrying a greater current than the other two phases, which are in series across the same lines. The value of the current in the odd phase will increase in a greater ratio to the normal than the current in the supply lines and overload relay coils.

Star- and Delta-wound Stators

When a fault develops either in the winding or line circuit with motors having a star-wound stator the phase current will be the same as the line current, and the normal overload setting of the relay will usually provide adequate protection as the current under this condition when single-phasing will be about seventy-five per cent. more than the corresponding three-phase value. Similarly, if a failure occurs in a phase winding of a delta-connected motor, the current in one line will exceed that flowing along the other two lines also by approximately seventy-five per cent., and so will be sufficient to operate the usual overload relays.

Thus, the worst case arises in connection with a delta-wound stator and a line fault, as the current in one phase winding may exceed the line current, and may be sufficient to destroy this winding without the normal overload relays operating.

The accompanying curves clearly indicate the importance of providing some form of protection for a motor against single-phasing either in the starter panel itself or the control circuit, the former for preference. Recently, the shut-down of a vital auxiliary unit was proved to be due to a 250-h.p. motor single-phasing owing to a faulty circuit-breaker contact, as the normal setting of the overload relays did not provide the requisite protection.

Several devices have been tried to protect the motor against single-phasing; these can be divided into two categories, namely, potential and current. The first is of the no-volt release type, consisting of no-volt coils connected across the lines so that failure of one line would result in tripping the main breaker. This simple method has drawbacks, *e.g.*, if the fault occurs on the motor side of the protective device the latter will not function, and if failure takes place on the line side, the induced voltage in the disconnected phase winding may be high enough to prevent the trips operating.

Attention has, therefore, been mainly devoted to the development of protective devices that depend upon the current actually flowing in the circuits, so that an interruption (either on the motor or line side) will cause the device to operate. Further, should failure take place in one phase only of a delta-connected winding, the same device will function due to the out-of-balance currents although all three lines are intact.

One type which combines both forms of excess-current protection comprises three thermal strips carrying the main current and an auxiliary switch for connection in the tripping circuit of the main control equipment. The strips are mounted between two hinged insulated bars, one placed above the other and held together by means of a spring. The heating of the thermal strips due to the current causes them to bend upwards thereby raising the upper bar, the lower one following on account of the spring attachment. When the bars are separated from each other by a given amount, a mechanical trip is actuated which provides normal overload protection.

If one line circuit is interrupted, its thermal strip will cool and bend down while the other two will continue to bend upwards so that the continued action of the strips will cause the two bars to separate and trip the auxiliary switch; this, in turn, will interrupt the no-volt circuit and thus trip the motor circuit-breaker.

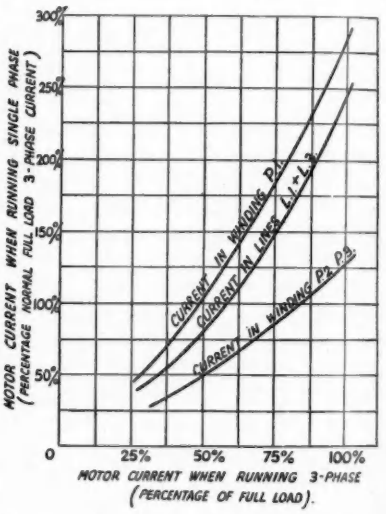


Fig. 2.—Relative values of line and phase currents in B (Fig. 1)

Another arrangement comprises three solenoids acting on a common plunger with the coils so arranged and connected that when the currents in the phases are equal, the plunger remains in a neutral position. If, however, due to any reason whatever, currents of different values pass through the coils, a pull will be exerted on the plunger causing it to move upwards and open a pair of contacts, thereby interrupting the operating or no-volt coil circuit. The circuit-breaker is thus automatically tripped, disconnecting the motor. This method is independent of temperature or other external conditions, relying entirely upon the magnetic pull on the plunger only when out-of-balance currents flow.

New Uses for Washing Machines

In order to recover gold dust from the overalls of operators which the cost of hand washing makes impracticable a firm of gold-pen manufacturers in the Midlands has installed a Hotpoint-B.T.H. washing machine. This requires square floor space of less than 24 in. and is placed close to the filter tanks with a water-pipe connection and stop-cock instead of the standard runaway pipe. After completion of the washing the water containing the gold dust is run off to the recovery vats, filtering and furnace installation. A test showed that the value of the gold recovered from five overalls immersed for six minutes was about 30s. An electric washing and wringing machine of the same make is in use for recovering raw lime juice from the bags (8 ft. long) through which the lime extract is filtered. Lime juice adheres to the outside of the bag and residues collect on the inside. Formerly the bags were washed in two vats, each 10 ft. by 4 ft. deep, and wrung by hand. One bag at a time is washed now in the machine, which is filled with cold water and forces the water through the fabric to cleanse the pores. After twelve bags have been dealt with the water is run back into the vats. The gain through saving in time as well as in recovery of the product is considerable. Another washer is being installed for mixing chemicals.

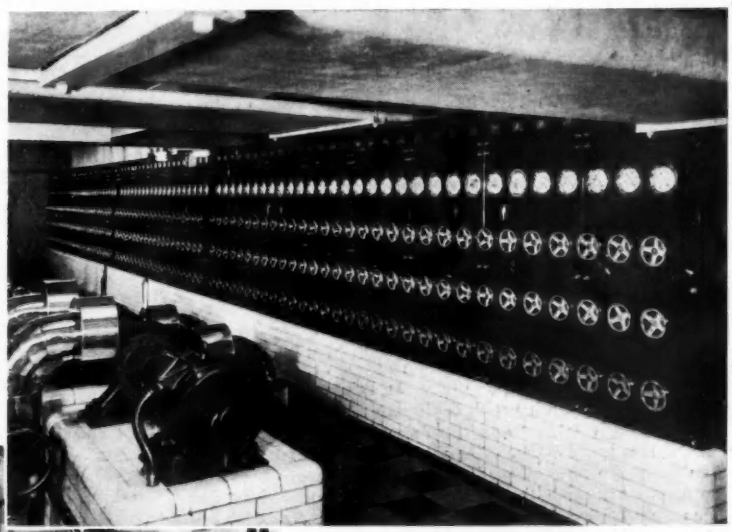
Thermal Storage Systems. By E. M. Ackery

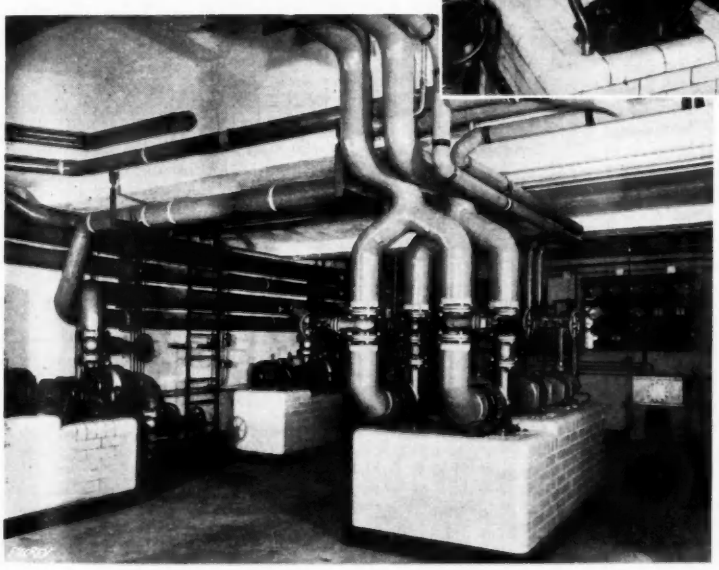
Points to be observed in designing their lay-out

THE statement is often made that, apart from the use of electrically generated heat and of storage tanks, an electric thermal-storage heating installation differs in no way from an ordinary heating installation, but this is not true in practice. The fact is that although the radiator system of a satisfactory electric thermal-storage installation would give good service if coupled to a suitable boiler using any type of fuel, be it coal, coke, oil or gas, a radiator system designed for a fuel-fired boiler would not necessarily be satisfactory when used in conjunction with an electric storage heater.

This apparent contradiction is explained by the various constructions put on the word "satisfactory." A system in which the distribution of heat is uneven, adequate heat in some parts being obtained only at the expense of overheating in other parts, or even by the use of supplementary heating in the form of electric fires and radiators, was considered a satisfactory ordinary heating installation in the past, and is often held to be a satisfactory job to-day. The usual form of guarantee stipulates that a certain temperature in the rooms must be obtained, but even distribution of heat is seldom mentioned and, indeed, there is a tendency for an attitude of "the more the better" to be adopted if a complaint is made that some rooms are too hot.

It is safe to say that, until the advent of electric heating for large buildings some ten years ago, the question of fuel consumption and operating costs of central heating installations received scant consideration. Fuel was relatively cheap; economy in consumption was not considered, and but few building owners knew or cared how much their heating installations were costing them. Central heating, although not in its infancy, was still in its youth, and the shortcomings that systems frequently possessed were accepted, almost without comment, as being unavoidable.





The heating controls in a large electric thermal-storage installation where full advantage has been taken of the possibilities of grouping (top). Accessibility and symmetry are the keynotes in the electric thermal-storage boiler room shown in the lower picture

With electric heating the running costs are readily available from day to day and, as refined electric heat is relatively expensive, the necessity to exercise every possible economy inevitably arises. No longer can the opening of windows to get rid of surplus heat in some rooms caused by the effort to get sufficient heat in other rooms be tolerated, nor is this state of affairs necessary. A far more stringent control of design is required, in which the following points should be noted. It is essential that radiators shall be accurately proportioned for their respective positions so that, under normal weather conditions, all rooms are at the required temperature; no overheating or underheating can be tolerated, nor can auxiliary heating by electric fires be permitted except where these are definitely required as a part of the scheme. Pipe sizing must be calculated to a nicety so that each radiator gets its fair share of water whatever the circulating temperature. The type of heating must be considered from the economy point of view, and it should not be forgotten that for intermittently occupied buildings such as offices, although panel heating may be more economical than radiator heating when coke-fired boilers are used, the same is not the case with thermal-storage and electric boilers. A most important point in all but the smallest systems is rational sectionalisation. If one side of the building is exposed to wind and another reaps much benefit from winter sun, they should be on separate groups that can be independently controlled. If certain sections of the building are seldom used they must form a group to themselves, but here a word of warning is necessary. In many civic buildings certain sections are often used for only a few days a week, but in these sections certain rooms may be used continuously. Such rooms must be on a special group, or a whole section will have to be heated for the sake of perhaps one or two rooms. It is impossible to be too careful in the selection and arrangement of groups, as alterations when the building is completed are expensive and unsatisfactory.

On the Continent, installations are normally designed with this regard for economy, whatever the type of fuel employed, but it is not yet the usual practice in this country, and it is not always done even where electric thermal-storage heating is installed.

The special care must not end with the design of the radiator system. Not only must the radiator and storage systems be good individually, but they must be properly linked together. The method of arranging the expansion tank and its connections needs special consideration; the stored water is at a temperature above the normal boiling point and must be treated with respect. Methods of temperature control that are satisfactory at, say 180 deg. F., will not necessarily be so at 240 deg. F. as, for example, the control that functions by virtue of alternate quantities of hot and cold water as opposed to definite mixing of the hot and cold.

The provision of domestic hot-water supplies is another problem that needs care and thought. An arrangement that is nicely balanced and works perfectly when maximum heating is required may cause trouble and waste of heat in mild weather when the heating load is small. False economy in design may mean that a large storage tank with its attendant heat loss has to be kept in commission during the summer in order to supply a small quantity of domestic hot water.

Finally, the arrangement of the central plant should reflect the spirit of electricity. It should be and look orderly. Apparatus should be conveniently placed for operation and inspection with a due regard to symmetry and appearance, and not simply where it happens to suit the run of the piping. As many recording instruments should be installed as is reasonable in relation to the size and nature of the job.

Obviously, the best results will be obtained if the entire design of thermal-storage plant and heating installation is in the hands of one competent individual or firm; divided responsibility is apt to lead to trouble. If different firms carry

out various parts of the contract there must be understanding and sympathy between them, and each must have as his sole aim the production of a sound completed system.

It may be argued that this is a matter for the heating engineer and not for the electrical engineer, nor yet for the supply authority, but it is inevitable that any shortcomings of an electric thermal-storage system, whether on the score of excessive running cost or of unsatisfactory operation, will be attributed to heating by electricity, even if it is abundantly clear to the expert that the radiator system alone is to blame. The mischief does not stop at blaming the job in question, but leads to a widespread suspicion of all forms of electric heating.

Ceramic Materials for Electrical Purposes

THE number of ceramic materials for electrical purposes has been increased and their qualities improved to such an extent during recent years as to render classification useful, if not essential, to their efficient utilisation. A basis for such classification is given in *Elektrotechnische Zeitschrift*, by W. Weicker, E. Kunstmann and W. Demuth, who have investigated the problem for the Association of German Electrotechnical Porcelain Manufacturers. The wide range available can be grouped nationally under the following headings, which can be extended if necessary :—

Properties of the various groups

1. Hard porcelains; preponderantly kaolinitic dense compositions. Characterised by well-balanced average qualities. Suitable for low-voltage insulators and (if spun or cast) for high-voltage insulators.
2. Steatite; dense compositions, mainly magnesium silicate. Small angle of loss, constancy of dimensions (particularly when dry-pressed), and great mechanical strength. Suitable for high- and low-voltage insulators, and especially for high frequencies.
3. Compositions with high percentage of titanium compounds (rutile). Specially high dielectric constants. Suitable for condensers, especially for high frequencies.
4. Kaolin-steatite compositions. Small coefficient of expansion and high resistance to arcing. Suitable for spark and arc guards.
5. Porous compositions consisting of kaolin, and sometimes magnesium silicate, with various additions. Very resistant to heat and suitable for electric heating appliances.

Representative average values for the physical properties of the ceramics in each of these groups are given in the accompanying table. Most of these data are derived from standard specimens in conformity with the testing rules of the German Ceramic Society (DKG) and the Association of German Electrical Engineers (VDE). The figures given serve primarily to compare the properties of the different classes of ceramics. The extent to which they are applicable to finished products depends on the size, shape and method of manufacture of the latter, including the burning and glazing.

The determination of properties from specimens cut from finished products is under examination, and the Dahlem institute for testing materials has developed apparatus for this purpose. The dielectric strength values given in the table relate to tests made on thin specimens (2 to 4 mm. thick) with hemispherical depressions having a conducting surface, the corresponding figures determined from complete insulators may be quite different. The widely cited value of 400 kg. per sq. cm. (5,690 lb. per sq. in.) for the tensile strength of porcelain applies only to spun parts and not to pressings.

The three main methods of manufacture employed in ceramics are turning or spinning, with or without a mould; casting from fluid in an absorbent mould; and pressing from a composition moistened with water and oil, or in the form of dry powder or granules. The dry-pressing process yields pieces of unvarying size and is specially applicable to materials of the steatite group. The wet pressing process is used for hard porcelain, but the properties of the product differ considerably from those of spun and cast material.

With the exception of the porous ceramics in group 5, all are of dense structure and the water absorption at 50 atm. (710 lb. per sq. in.) for 1 hr, is 0 to 0.5 per cent, for pressed-hard porcelain, group 1 (c), and zero in all other cases excepting group 5, to which this test is inapplicable. The hardness of all groups is equivalent to that of quartz or topaz. All the ceramics considered are unaffected, at ordinary temperature, by all alkalis and acids, with the exception of hydrofluoric acid.

The properties of the porcelains in group 1 depend upon the actual proportions of kaolin clay body (hydrated aluminium silicate), felspar and quartz, and it is impossible to realise the highest values of all the properties considered in any single mixture. The main constituent of group 2 is steatite or talc, a hydrated magnesium silicate, consolidated with various additions according to the properties desired. The special compositions in group 2 (b) have a very low loss angle, making them specially suitable for high-frequency applications.

The very high dielectric constant of the materials in group 3, combined with low dielectric loss, makes these ceramics particularly useful in the manufacture of high capacity condensers occupying exceptionally small space. The very low temperature variation of dielectric constant of some materials in this group makes them specially valuable in high-frequency applications.

The ceramics specified in group 4 are of composition intermediate between those of group 1 rich in clay body and those of group 2 rich in magnesia. Their low coefficient of thermal expansion renders them suitable for use wherever special resistance to arcing, sparking or other marked temperature variations is required, and they are used in special cases for high-frequency apparatus.

Group 5 includes a variety of porous ceramics which, although inferior to dense ceramics in insulating quality at room temperature, are nevertheless invaluable for supporting the elements of heating appliances owing to their indifference to temperature changes and their low thermal conductivity. The range of properties in this group is necessarily wide, because of the different compositions employed. In general, the coarse-pored materials are preferable to the porcelains, steatites and the mechanically somewhat superior fine-pored materials in heating applications owing to their being unaffected by rapid heating and cooling. Some of the materials of this class, combining low thermal expansion with good mechanical qualities, have been developed as variations of ceramics in group 4, and they are specially suitable for use in hot plates and arc-extinction chambers.

	Group 1.			Group 2.		Group 3.		Group 4.	Group 5.
	(a) Turned or spun.	(b) Cast.	(c) Pressed.	(a) Normal.	(b) Special.	(a)	(b)		
Specific gravity	2.3–2.5	2.3–2.5	2.3–2.5	2.6–2.8	2.6–2.8	3.9	3.6	2.2	1.6–2.5
Tensile strength, glazed kg./sq. cm.	300–500	—	—	550–850	550–950	300–600	300–500	260–360	90–160
" " unglazed "	240–320	—	—						
Compression strength, glazed "	4,000–5,500	4,000–5,500	3,000–4,000	8,500–9,500	9,000–10,000	6,000–12,000	3,000–5,000	2,800–5,000	500–2,000
" " unglazed "	4,000–4,500	4,000–4,500	3,000–3,500						
Bending strength, glazed "	900–1,000	900–1,000	600–700	1,200–1,400	1,400–1,600	1,000–1,500	900–1,500	500–850	150–400
" " unglazed "	400–800	400–800	300–600						
Impact strength, cm. kg./sq. cm.	1.8–2.2	1.8–2.2	1.3–1.6	3–5	4–5	2.8–3.3	2.5–3.0	1.8–2.2	1.0–1.9
Modulus of elasticity, 10^6 kg./sq. cm.	0.7–0.8	0.7–0.8	0.7–0.8	0.9–1.1	0.9–1.1	1.1–1.3	0.9–1.1	0.9	—
Coeff. of thermal expansion, linear, 20–100 deg. C., 10^{-4} mm./metre deg. C.	3.0–3.5	3.0–3.5	3.0–3.5	7–9	6.2–7.8	7–8	6–7	1.1	1.8–4.8
Softening temperature, approx., deg. C.	1,500	1,500	1,500	1,400	1,400	1,500	1,500	1,400	1,400–1,500
Breakdown strength, at 50 cycs., kV/mm.	34–38	34–38	—	20–30	34–45	10	15–20	20	—
" " 10^6 cycs., "	—	—	—	—	25–27	—	—	—	—
Dielectric constant, at 50 cycles	5.0–6.5	5.0–6.5	—	5.5–6.5	5.6–6.5	80–88	40	5–5.5	—
" " 10^6–10^7 cycles	—	—	—	—	—	70–80	—	—	—
Dielectric loss factor, at 50 cycs., $10^4 \tan\delta$	170–250	170–250	—	25–30	10–15	—	—	200	—
" " " 800 cycs., "	—	—	—	—	9	300	100	—	—
" " " 10^6–10^7 cycs., "	70–120	70–120	—	15–20	3–5	3–15	6–20	40–70	—
Insln. resistance (d.c.), at :—				—	—	—	—	—	—
20 deg. C. ohm-cm.		Over 10^{14}		6×10^9	ca. 10^{12}	—	—	$1.2–25\times10^8$	$3.2–200\times10^6$
200 deg. C. "		$1.6–200\times10^7$		1×10^8	$2.5–3.0\times10^{10}$	25×10^6	1.2×10^6	$6.0–70\times10^6$	$1.0–25\times10^7$
300 deg. C. "		$1.0–40\times10^6$		7×10^6	$1.5–1.9\times10^9$	—	—	$5.0–56\times10^5$	$1.0–16\times10^7$
400 deg. C. "		$1.6–34\times10^5$		1×10^6	$1.5–2.0\times10^8$	—	—	$7.6–76\times10^4$	$1.5–18\times10^6$
500 deg. C. "		$3.4–45\times10^4$		3×10^5	$2.3–3.3\times10^7$	—	—	$2.4–23\times10^4$	$3.6–31\times10^5$
600 deg. C. "		$1.0–10\times10^4$							

Greenhouse and Soil Heating. By T. D. Oswald, B.Sc.

A statistical method of forecasting results

THE subject of greenhouse and soil heating by electricity has been dealt with in a qualitative manner in recent articles in the ELECTRICAL REVIEW. The experimental investigation described below affords statistical records of performance under working conditions.

A small greenhouse, 15 ft. by 8 ft. by 8 ft., was erected in the grounds of a sub-station. Heating was carried out by a water-pipe system beneath the benches, an immersion heater being placed in the header. The loading was determined by means of heat transmission coefficients, the area of the surface considered being multiplied by its appropriate coefficient (K) to give the B.th.u. per hr. per deg. F. above the surroundings.

TABLE I.

Item.	sq. ft.	K.	B.th.u. per hr. per deg.
Glass	288	1.11	319.7
Floor	120	0.24	28.8
Wall	138	0.49	67.6
Air	588 cu. ft.	0.19	111.7
Total			547.8

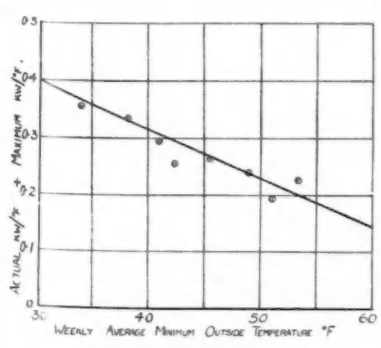
The air was assumed to be changed once per hour, which would occur by natural infiltration. Stagnant air must be avoided to prevent formation of mildew. The figure 547.8 B.th.u. per hr. per day was divided by 3,412 to give the loading required of 0.161 kW per deg. F. It is usual to take the minimum outside temperature as 30 deg. F., and if the inside temperature is not to fall below, say, 45 deg. F., the difference to be maintained is 15 deg. F.; this multiplied by 0.161 gives the loading required as 2.42 kW. Actually, a 3-kW thermostatically controlled heater was fitted, the thermostat automatically cutting off the heater when the required temperature was reached.

The consumption of the greenhouse was recorded by a separate meter and was read each morning. Maximum and minimum temperature records were made from the temperatures inside and outside. Table II gives weekly average values of the essential statistics. The last column of this table gives average kW per deg., and the figures vary from about 0.03 at high to about 0.07 at low outside temperatures. The reduction in practice from the calculated value of 0.161 kW per deg. is due to the heat input from the sun. From the experimental data available it is possible to allow for this and to evolve a system of estimating the consumption of electricity for greenhouses of this type.

TABLE II.

Date.	Average kWh per hr.	Thermostat setting.	Average minimum outside temperature.	kWh per hr. per deg. F. difference.
Apr. 1–8 ...	0.63	45	34	0.0573
8–15 ...	0.47	45	38.3	0.0702
15–22 ...	0.242	45	41.5	0.0691
22–28 ...	0.16	45	40	0.032
28—May 5	0.343	50	41.7	0.0413
May 5–12 ...	0.192	50	45.3	0.0409
12–15 ...	0.445	50	38.3	0.0381
15–22 ...	0.671	55	40.7	0.047
22–29 ...	0.518	55	42.4	0.0412
29–June 5...	0.398	55	46	0.0443
June 5–12 ...	0.232	55	49	0.0386
12–19 ...	0.062	55	53.3	0.0365
19–26 ...	0.49	55	47.3	0.0636
26–July 4 ...	0.126	55	51	0.0315

When the values of kWh per hr. per deg. difference are divided by the maximum kW per deg. difference (*i.e.*, 0.161, obtained by calculation) the data is reduced to a form which is applicable to any greenhouse of the type used in the experiment. The graph is made by taking the mean of the results over every 2 deg. on a base of average weekly minimum outside temperatures. A reasonable representation of the facts may be made by a straight line, which may be liable to modification when further records are available. The graph enables a quantitative estimate of the consumption of electrical energy to be made.



Mean greenhouse load

For example, to maintain the experimental greenhouse at 50 deg. F. when the minimum outside temperature is at 45 deg. F. will require 0.161 kW per deg. × 5 deg. F. × 0.26 = 0.209 kWh per hr., where 0.26 is the factor read from the graph, corresponding to 45 deg. F. minimum outside temperature.

In these estimates the minimum temperatures are used in preference to the mean temperatures throughout the whole day, as although the mean temperature may be above the thermostat setting and would lead one to expect zero consumption, the minimum temperature may be below the setting and electricity would be used. It is, therefore, better to use the minimum temperature as a basis and reduce by the appropriate factor which is based on statistical data. Table III gives typical values of the average minimum temperatures for each month of the year in N.E. England, and the corresponding factor read from the accompanying graph.

[*Jerome*

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If the greenhouse is to be maintained at 45 deg. F. the temperature difference between outside and inside during January will be 13 deg. F., during February 12 deg. F., and so on, by subtraction.

The temperature difference for each month is multiplied by its appropriate factor and the number of hours in the month. The figure so obtained can then be tabulated for greenhouse temperatures of 40, 45, 50, 55, and 60 deg. F. and used directly in estimating the consumption of the greenhouse over any period at any temperature. For the experimental greenhouse the annual consumption for maintaining 45 deg. was 29,315 × 0.161 = 4,720 kWh.

During June, July and August, no heating need be used in many cases. The heat stored in the greenhouse is quite considerable; calculations show that with an external temperature of 30 deg. F. the greenhouse takes over 2½ hours to cool from 50 to 40 deg. F. With more moderate summer conditions and short nights there will be little danger in leaving the greenhouse unheated. By setting the thermostat at 40 deg. F. effective protection is provided against sharp frosts which are a possible contingency.

The above method of calculating consumption is necessarily based on averages, and over long periods it will give reasonably correct values, but over short periods it cannot be expected to be highly accurate. The effect of excessive ventilation was shown by one night in which a ventilator was accidentally left open, when 22.4 kWh was used as compared with a similar night with ventilators closed when only 15.8 kWh was used. Rain was responsible for a considerable increase in the consumption. On a dry day in June 14.2 kWh was recorded; for a day in the same week when there was a twenty-four hour rainfall the consumption was 30.4 kWh. Operating conditions under snow have not yet been observed.

TABLE III.

Average min. temp....	Jan. 32	Feb. 33	Mar. 34	Apl. 37	May. 39	Jun. 45	Jly. 50	Aug. 49	Sep. 46	Oct. 42	Nov. 37	Dec. 33
Factor from graph...	0.38	0.37	0.36	0.335	0.315	0.26	0.215	0.225	0.225	0.29	0.335	0.37

Test Results

The effect of soil-heating cables on the growth of vegetables was tested in an experimental garden adjacent to the greenhouse. The total area available for cultivation was about 2,600 sq. ft., half of which was warmed by soil-heating cable and, for comparative purposes, the other half was worked under natural conditions. Eleven lengths of 700-W soil-heating cable were laid in the heated area, and were switched on by a time-switch at 7 p.m. and off at 8 a.m. This layout consumed 14,000 kWh from March 14th to August 24th. Owing to the large number of people having access to the garden it was not found possible to keep a record of the weight of produce yielded by the warmed area as compared with the unwarmed area. The time required for the crops to germinate and appear above the surface was, however, observed, and is given in table IV.

The rate of germination of many vegetables, in particular lettuce, appeared to be unaffected by soil heating. Peas and

beans were the most promising; all varieties showed a saving of six to eighteen days in germination and, especially in the case of beans, this lead was maintained or improved on subsequently, those heated being a good eight inches higher than the others during the growing period. Most other plants, after appearing above the ground, remained in a quiescent state as though they had got beyond the influence of the heat in the soil.

TABLE IV.

Produce.	Date sown.	Days to germinate. Heated	Natural
Beans (broad)	Mar. 19th	26	32
" (kidney)	May 2nd	14	32
Beet (globe)	May 2nd	18	19
" "	May 10th	12	18
" (spinach)	May 10th	13	13
Carrots	May 11th	28	28
Lettuce (Cos)	May 10th	12	12
" (Greatheart)	May 10th	12	12
" (Paris white)	May 10th	12	12
Parsley	Mar. 19th	43	43
Peas (Pilot)	Mar. 19th	21	31
Peas (Stratagem)	May 2nd	9	14
Potatoes (Sharp's Express)	Mar. 21st	34	43
Radish	June 5th	6	6
Spinach	May 11th	13	13

As a result of the experiments the following conclusions have been reached.

The probable consumption of an electrically heated greenhouse may be estimated by utilising statistical records.

The graph of actual kW per deg. divided by maximum kW per deg. (difference in temperature between the air inside and outside the greenhouse) expressed as a fraction of the average minimum temperature during each week is approximately linear.

By using minimum values of temperature and correcting by a statistical factor the consumption can be estimated, although the setting of the thermostat may be above the average temperature throughout the week.

The forcing of plants in the open by means of soil-heating cables does not seem to be universally applicable; experience will indicate which crops can be advantageously speeded up by soil heating.

Wholesale application of soil heating should not be advocated until tests have been made on its effect on the crop considered. It is better that the limitations of the method should be appreciated and reliable information made available in order to ensure satisfaction to consumers.

Acknowledgment is due to the Newcastle & District Electric Lighting Co., Ltd., for the information given above.

The Contractors' Dinner

OVER 400 members and guests attended the annual dinner of the Electrical Contractors' Association (and allied Associations) at the Savoy Hotel, London, on Tuesday evening, the chair being taken by the President, Mr. A. G. Bruty.

Following the loyal toast, Mr. J. M. Kennedy, Pres. I.E.E., proposed the toast of "The Allied Associations and Honorary Officials," and in the course of his speech said that everyone in the industry had ideas for improving the position, and each section had different ideas. But to attain the greatest possible use of electricity every section must pull its full weight.

During his travels in many parts of the country he was often told that it was impossible to achieve in a particular area the results which had been obtained in a district a few miles away on account of local differences. It seemed strange that one area could sell plenty of electricity and achieve co-operation between the contractors and the supply industry while a nearby town could not. He thought that there was a need for a public relations officer to go round to the various areas and smooth out differences to the general benefit. Apart from co-operation, however, faith and enthusiasm were necessary to the success of the service which we had to offer.

Electricity was now the handmaiden of humanity, and it should be the poor man's friend—that was the problem with which we were faced and for the solution of which we needed all the brains in the supply and contracting industries. In the first place, those in the industry must set an example. How many men in important positions in the industry could boast of all-electric homes? The contractors, particularly, should make full use of electricity, for their daily work brought them into the closest contact with the public and they should be able to speak from experience. If suitable tariffs and wiring schemes were not available the contractors should persuade the supply authorities to remedy matters, and he assured them that they would have the full support of the Electricity Commissioners.

Contractors and the Sale of Electricity

In responding, Mr. Bruty said that he would keep clear of purely "domestic" matters and confine himself to one of the most important questions of the day—the selling of electricity. Many millions had been spent on the grid and standardisation of frequency and the public wanted to see results. How was the grid to be loaded and the full benefit of electricity brought to the people? He thought that there had never been a real effort to enlist the services of all the interested people who were available. There had been efforts at co-operation and load-building, but in many places the local supply authority had built its load not by any efforts of its own so much as by having a load thrust upon it by clamorous consumers. In other areas the authorities were so fearful of the service which they had to sell that they induced the public to buy it by offering free points and uneconomic hire and hire-purchase schemes. Electricity could be sold on its merits if a live organisation existed.

The Association claimed that its members were men of energy, spirit, enterprise and initiative who stood for the highest class of work and who had taken an active part in the organisation of the industry. The success of the industry depended absolutely upon increased recognition of the contractor's position in the electrical scheme of things.

Some supply authorities presented violent opposition to their local contractors, but in more enlightened areas the authority recognised that theirs was a common cause and supported the contractors. The local branch of the E.C.A. should be the focal point to which every supply engineer should direct his eye, and he should make every possible use of the organisation to improve his load. In this way the E.C.A. could become a nation-wide organisation for selling electricity. The supply authorities should cease to be wiring contractors and retail traders and concentrate their efforts on the production of a cheap and abundant supply of electricity, selling it in co-operation with the contractors.

In every area the E.C.A. branch would form an electrical circle in close touch with the supply authority and these circles would be connected up through a suitable organisation to a main propaganda office which would supply literature, statistics and sales matter. There would be a power sales director co-ordinating these activities and a number of travelling officers to maintain contact between this official and the local E.C.A. circles. Mr. Bruty said that he wanted to weld electrical contracting into the main structure of the electrical industry to strengthen and enhance its development ability, for nobody had a keener interest in its success than the electrical contractor.

The Attitude of the I.M.E.A.

Mr. H. Marryat (past-president), proposing the health of the guests, referred to the presence of Sir John Brooke, who, as vice-chairman of the Electricity Commission, had the last word in many matters vitally affecting the contracting industry. Mr. Seddon, the president of the I.M.E.A., had a difficult task in following Mr. Hoadley, who had done so much during his year of office. There were some members of the I.M.E.A. who showed a broadminded spirit towards the contractors, but as a body that Association had not risen to the high level from which it could regard the industry as a whole rather than sectionally. After referring to other prominent guests, Mr. Marryat said that while there might not be many people in this country who were "100 per cent. electrical," the contractors stood well in this respect.

Sir John Brooke, replying to the toast, said that the Electricity Commissioners held the Association in high regard, for they knew that it stood for first-class work. On the matter of co-operation, while it was desirable to reduce internal friction it should be done so as to raise the power output to the maximum. The necessity for earning a living was an incentive to a live commercial spirit. The municipal supply authorities were bound to enter into certain activities, such as the establishment of showrooms, but if they and the contractors were ready to co-operate great headway could be made.

Mr. E. Seddon, also replying, said that electricity was rapidly becoming an economic necessity. He thought that contractors themselves did not use electricity as much as they should. It was necessary if customers were to be convinced of the benefits of their service. The need for educating the public was urgent, for people were so absorbed by their own affairs that they did not realise the advance which electricity had made. The contractor would continue to hold his place as a part of the industry if he carried out his work well and at a fair margin of profit.

Sir Felix Pole, who also responded, said that the E.C.A. was an essential link in the industry. Organisation of industry was in the air. The electrical industry had now reached a state of prosperity, and now was the time to complete its organisation in preparation for the inevitable rainy day.

The chairman's health was proposed by Mr. T. J. Gallagher (chairman, Dublin Branch, E.C.A.), and Mr. Bruty replied.

Feed-water Regulation.

By V. Walker, A.M.I.E.E.

Maintaining the level in modern boilers

THE problem of feed-water control has been complicated to a large extent by the increase in capacity of modern boiler units, accompanied by an increase in the working pressure. Relatively small water storage and the extensive use of water-cooled furnaces have also contributed to the difficulties encountered. Fluctuations in load, especially where pulverised fuel is used, are often so rapid that without feed regulation, changes in the water level due to the effect of "swell" and "shrinkage" become serious. This effect is due to the entrained steam bubbles which are an appreciable proportion of the water-steam mixture at high rates of evaporation.

With a sudden loss of load the steam pressure rises, and the water level in the drum may fall out of sight in the gauge glass; this is due to the suppression of the steam bubbles by the increase in pressure and decrease in evaporation. On the other hand, if the load is suddenly increased, the water level will rise, due to the formation of steam bubbles below the water level and change in the rate of circulation within the boiler, and priming may result. In some boilers the only way of maintaining the water level within safe operating limits is by regulation, which maintains a higher level with increased rating, thus providing increased water storage, so that the level will not drop below the water-tube connections when shrinkage takes place following a reduction in the steaming rate. In one respect, the use of high pressure has proved a favourable factor. As the pressure increases, the specific gravity of the steam and water become more equal, so that the changes in volume are not so great when the water changes into steam. This advantage has been found to be quite marked above 1,000 lb. per sq. in. working pressure. In many high-pressure units, however, the water storage represents only a short period of operating time, so that the feed-water control must be quick in action.

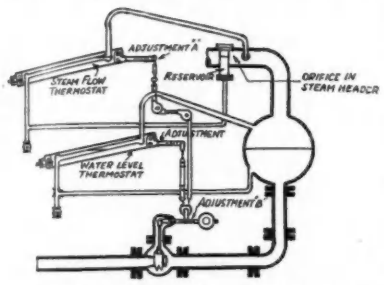


Fig. 1.—Cope two-element regulator

With boilers having ample water storage water-level changes are not a disadvantage, as some of the excess furnace heat can be absorbed in the incoming feed-water on a decrease of load, and released on an increase by purposely retarding the feed supply. This also tends to maintain the boiler pressure uniform and to decrease the variations needed in the combustion rate. Under such conditions feed-water regulation actuated only by the change in the water level will give satisfactory automatic control in certain circumstances. Regulation operated by drum level alone varies the valve opening as the water level varies. This means that if the water level in the boiler is constant for an interval, and the excess pressure in the feed line varies, the rate of feeding will vary correspondingly, tending to give an uneven rate of feeding and wide variation between steam output and water input. The present method of overcoming this difficulty is to install a pressure differential or constant excess-pressure valve ahead of the feed-water regulating valve. This valve keeps a constant pressure drop across the feed-water regulating valve irrespective of the valve opening or feed-water pressure.

Where the drum capacity is small in comparison with the total output of steam, and where the load changes are rapid and of major importance, feed-water regulation solely from water level changes is inadvisable.

Supplementary Control

The so-called one-element regulation is, therefore, supplemented by an automatic unit directly responsive to the rate of steam flow which will overcome the effect of swell and shrinkage. Two or three elements are used to control this type of regulator. These are steam flow, drum-water level, and feed-water flow. The Cope two-element regulator is actuated by two thermostats. The upper end of the steam-flow thermostat is connected to the main steam piping, the lower or water connection being made to a reservoir connected to the steam header at the level of the upper end of the thermostat. Steam condensing in the thermostat fills the water connections and reservoir. At no load the steam-flow thermostat is filled with water, and as the load increases the difference in pressure between the two connections in the steam header, measured by an orifice, a pilot tube or the friction losses between the two connections, forces the water level down.

Steam enters the thermostat, expanding it and opening the feed valve. As the load decreases the water level in the expansion tube rises, causing the tube to contract and to close the feed valve. When the water level in the boiler drum changes, the thermostat influences the rate of feeding. If the level is constant, the feed-valve movement is under the sole influence of the steam-flow thermostat. By adjustment, the influence of either thermostat can be increased or decreased. Thus the ratio of inflow to outflow can be controlled so that high water level can be carried at high load and low level at low load, or the reverse.

A Three-element System

The Bailey three-element feed-water control is operated by the feed-water flow to the boiler as well as by the steam flow and water level. These metered factors are co-ordinated by means of linkage to operate an electrical transmission system to a hydraulically operated feed-water control valve. The demand for feed-water is measured by steam and water level, which provides for a variable water level which increases with rating so as to prevent water shrinkage from draining the water storage space when the load suddenly drops. The feed-water demand, as measured by the combination of steam flow and water level, is geared to the water flow itself, instead of directly to the regulating valve in the feed line. This method of gearing demand to water flow provides for the large and rapid load changes and variations in excess pressure. It also co-ordinates water flow with steam flow at all times.

The Selsyn method of electrical transmission is used as a connection between the flow meters and feed regulating valve. It consists of two identical units similar to induction motors, with stator windings in parallel; the rotors are also connected in parallel and to an a.c. supply.

By transformer action, voltages are induced in the stator windings, their magnitude depending on the angular position of the rotor. If the rotors are in a similar angular relationship to the stator, there are no circulating currents in the stator windings, and no torque on the rotors. If one of the rotors

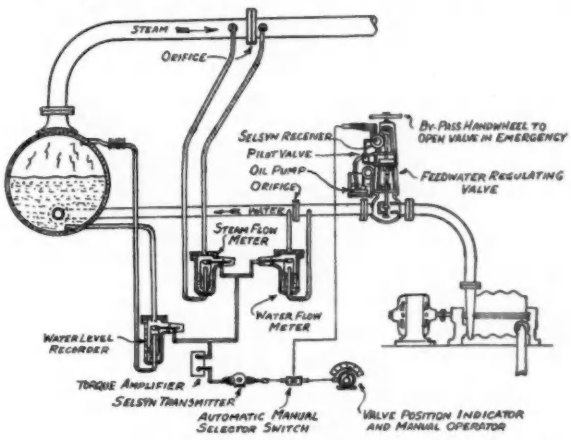


Fig. 2.—Bailey three-element control

is displaced, the voltage balance of the stator will be disturbed and circulating currents flow, tending to turn the other rotor until the voltages are again balanced.

The movement of the linkage between the three elements causes the Selsyn unit to take up a position proportional to the feed-water requirements. The receiving unit operates a pilot valve which, through oil pressure, regulates the water control valve; the control valve is supplied with its own motor-driven oil pump. The system includes a valve position indicator. A hand control is incorporated to permit independent manual operation of the control valve by operation of a switch, after which the valve may be positioned by the use of a knob on the valve position indicator.

I.E.E. Western Centre Summer Meeting

The Western Centre of the Institution of Electrical Engineers has decided to hold a summer meeting at the Abernant Lake Hotel, Llanwrtyd Wells, during the week-end of May 22nd to 25th. Members desiring to take part (£3 5s. per person) should notify Mr. H. R. Beasant, 77, Old Market Street, Bristol, 8, as soon as possible.

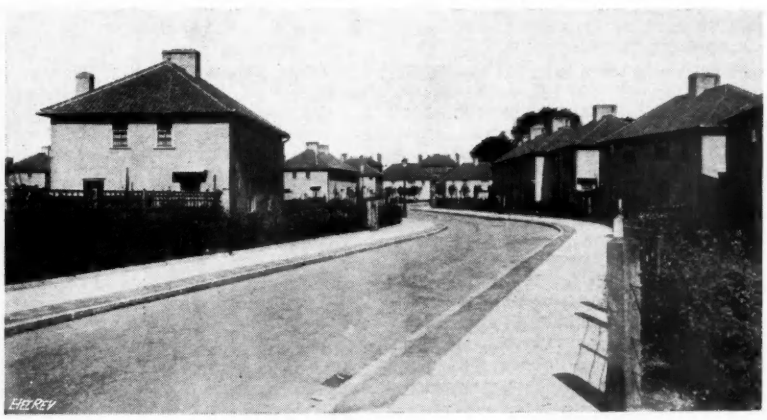
Canvassing the Builder. By A. V. Cross

THE building boom of recent times has afforded an opportunity for electrical development the importance of which has not been treated seriously. When I speak of building I refer not only to dwelling houses and flats, but also to shops, offices and works. The remarks expressed in this article, however, are confined to dwelling houses.

People responsible for the erection of new property may be (1) the estate promoter, (2) the old-established local builder with years of standing locally, (3) the jobbing builder on a small scale, or (4) the speculative type. The first is either a builder of repute offering value for money in the shape of a well-built house, or one who puts up an estate and luckily manages to sell out, then moves on to another locality to repeat the process. The second is the builder who, by being well known in a particular locality, inspires confidence in intending home-seekers as the man to give satisfaction and meet all requirements. The third usually builds, when not employed by others, invariably for himself, relatives or friends. Number four is frequently not a builder at all. He simply buys the materials.

In whichever class the builder falls, he is, nevertheless, doing business which affects the electricity undertaking. Whether all the domestic business eventually comes to the undertaking or not is no excuse for expecting him to take electricity for granted. How many supply undertakings imagine that the local builder knows all about the facilities offered by their undertaking; look upon the builder, especially the estate promoter, as an unmitigated nuisance; or have devised anything resembling a routine for approaching builders and putting the electrical message over with force and conviction? I hazard a guess that the answers to the first and second questions would be "nearly all" and to the third "very few."

During the course of my daily routine and contact with builders and householders I have realised that a method is desirable whereby a builder can be made a vital link in the chain of electrical propaganda. Although he is not to be expected to sell the electrical idea for us, seeing that his business is to dispose of the houses when built, it has become apparent to me that by incorporating the electrical idea as a selling feature he would be doing himself a good turn as well as helping the supply undertakings to a considerable extent.



[Courtesy, London County Council

A typical modern municipal housing estate

I am satisfied from my own experiences that good results can be obtained if builders are approached in a businesslike manner. An opportunity is only too willingly afforded for the development representative to discuss the whole aspect of domestic electrification. Many businesses to-day, including electricity supply undertakings, are guilty of taking the customer for granted, and much is lost through that spirit and the consequent neglect to make personal contact.

Anticipating Building Development

Ascertaining when property is to be erected and following up the prospective builder can be accomplished in the following manner: If the electricity authority is the local Council it is a simple matter to obtain a statement of plans for new property. The names and addresses of those who submitted plans can be ascertained, and the sooner they are approached with the electrical idea the better, the opportunity being taken "to put it over" before the gas competitor states his case.

The purpose of the approach is not necessarily to secure the installation contract, although to submit a tender for this work is not to be ignored, but to make known the facilities available for the hiring of electric cookers, water heaters, fires, &c., and other terms for supplying such apparatus.

The scale of charges in force for domestic supplies should be briefly explained, the most being made of the advantages of a two-part tariff to users who install appliances. It is also helpful to quote running costs in average households for cookers, water heaters, &c., based on comparisons obtained or, more convincing still, one's personal experience, the object being, of course, to enable the builder or his agent to be as familiar with the uses and costs of operating electrical appliances as is commonly the case with alternative means.

Before concluding the discussion it is impressing to attempt to point out how much money can be saved in construction by omitting grates, flues and chimney breasts in rooms by wiring for electrical inset fires or providing heavy-duty plug points for portable fires. Care should be taken to avoid giving the builder an impression that he is being told how or what to design in his own property.

[Jerome, Ltd.

Mr. A. V. Cross is employed by the Reading Corporation as electrical development assistant

Suitable Literature

Upon leaving him I have always made a point of handing to him the booklet produced by the General Electric Co., Ltd., entitled "Electricity Sells Modern Houses," and E.D.A.'s "Electric House Building" booklet No. 1203, together with the Department's pamphlets describing hiring facilities and tariff of charges. They are all necessary reminders and useful as a means of supporting what has been discussed at the interview; they are very often of value for reference when the builder is designing his future installation and in the preparation of a handbook giving the details of the estate.

It is said that the hope of reward sweetens labour, and I find it similarly gratifying when visiting an estate during erection to notice that my ideas and suggestions have been followed. One is bound to experience a feeling of encouragement when the hitherto familiar gas point near the fireplace is replaced by an electric plug point. The courage to provide a plug point leads to bigger things and often manifests itself by the appearance of the all-important cooker circuit or immersion-heating installation.

The Junior Institution of Engineers

The annual dinner of this Institution at the Hotel Metropole on March 13th with Sir Frank Smith (president) in the chair, marked the fifty-second anniversary of its foundation. The toast of "The Institution" was proposed by Sir Robert Robertson, who referred to its activities as complementary to those of the senior societies, in co-ordinating technical and practical knowledge and in maintaining an unemployment register. Response was made by Mr. A. E. Bingham (chairman, J.I.E.), who claimed that the Institution had shown the senior bodies how to run informal meetings and look after younger engineers. Proposing "Research" Sir Arnold Wilson said that the duty of science was to avoid waste and the frustration that came from it. Research was of little value unless it was combined with observation by practical engineers. The president recalled that when he started his career thirty-five years ago as the first scientific assistant of the National Physical Laboratory (which did not become a Government concern until 1919) there were no large industrial laboratories. There was more experimental investigation to-day than ever before, and one of its finds, television, he regarded as one of the greatest scientific achievements of all time. In proposing "The Guests" Mr. H. G. Pusey (vice-chairman, J.I.E.) mentioned that a large number of members were also members of the I.E.E. and I.Mech.E. Mr. H. N. Gresley (president, I.Mech.E.), and Mr. J. M. Kennedy (president, I.E.E.) responded. The chairman was thanked by Mr. A. P. Morris, and appropriate recognition was given to the work of the secretary (Mr. H. G. Riddle) and his staff.

Meetings and Discussions

Electric Furnace Progress
Industrial Switchgear
X-ray Cinema Films

Electric Furnaces

At the informal meeting of the Institution of Electrical Engineers in London on March 9th Mr. W. S. Gifford opened a discussion by stating that the total connected load of all types of electric furnaces in the United Kingdom was at least 150,000 kW. When times were good, as at present, most furnaces worked continuously for five and a half days a week, so that their total annual consumption was not less than 450,000,000 kWh. With power at 0.5d. per kWh, this represented an annual power bill of about £1,000,000. The total plant ordered last year was at least 30,000 kW, which was equivalent to over 75,000,000 kWh per annum, or an additional power bill of over £150,000. He asked that the value of this load should be recognised and encouraged by offers of reasonable power contracts. In some instances special terms were given to electric furnace users, but the practice was by no means general.

Arc furnaces, which were principally used for steel making and the production of ferro-alloys and carbide, had been commercially developed for about twenty-six years. The principal modifications in modern furnaces were the increase of transformer rating, with a corresponding increase of voltage, and the provision in some cases of removable roofs to facilitate rapid charging.

The high-frequency, or coreless, induction furnace was now being very widely used for the manufacture of high grade steel. Frequencies varying from 500 to 2,200 were used, the size of furnace ranging from 100 lb. to 5 tons, and the power from 30 to 1,250 kW. A high-frequency furnace installation consisted of a motor-generator; a bank of condensers to improve the power factor, arranged so that part was constantly in circuit and the balance divided into a number of units which could be switched in or out to suit the varying load conditions; and one or more furnaces with the necessary tilting motors, cables, etc. The fact that several furnaces of different sizes could be run from the same electrical equipment was a decided advantage.

The Ajax-Wyatt, a normal frequency induction furnace, was very widely used for the production of brass. About 1,000 of these furnaces were in operation in various countries, including about 90 in England. This type of furnace was extremely efficient, and easy and cheap to operate, but unsuitable for melting high temperature material such as steel, or for making a wide range of different products. These furnaces were usually of 600, 1,200, or 2,400 lb. capacity with transformers of 75, 150 or 300 kVA.

Other types of furnace for melting bronze and cast iron in relatively small units were the rocking resistor and the rocking arc furnaces. In the former heat was supplied by a graphite resistor rod, and in the latter by a horizontal arc. In both types the furnace was rocked to ensure thorough mixing and to increase the life of the refractories. These furnaces were limited in size, as they were only suitable for single-phase current. Resistance furnaces were principally used for the heat treatment of ferrous and non-ferrous metals, for melting at low temperatures such metals as aluminium and lead, and for pottery manufacture.

A recent very important advance had been made in high frequency induction heating. Crankshafts and similar articles were heated by current at about 2,000 cycles carried by hollow inductor coils, and rapidly quenched by water squirted through holes in the coils. By this means very efficient surface hardening was obtained extremely rapidly. The actual heating period was only 7 seconds, and the complete cycle, including quenching and setting up the coil, was under 45 seconds. If this was compared with the nitriding process, in which the time required for heating was over 40 hours, the advantages of this method would be obvious. High frequency current was also being used to graphitise carbon electrodes, and had many advantages over the ordinary method, in which the amorphous electrodes were graphitised by passing a very heavy current through the furnace.

The main advantages which electric furnaces had established over all other types were cleanliness and accuracy.

* * *

Switchgear in Factories

Types of switches, controllers and protective gear employed for distributing electricity within industrial establishments were dealt with in a paper by Mr. G. L. Walker presented before the Association of Supervising Electrical Engineers in London on March 17th. High-voltage switchgear (11 kV being the upper limit considered) was usually of the totally enclosed ironclad pattern, being more compact and needing smaller clearances (because of the compound or oil filling of the busbar and connection chambers) than cubicle or truck type gear. Fixed cubicle gear with its vertical layout needed less floor space than the horizontal truck type, which also required withdrawal space. But interchangeability of trucks, ease of maintenance, and accessibility were valuable features.

For large motors it was frequently advantageous to employ high-voltage distribution. For example, a 1,500-h.p. three-phase induction motor would need a stator switch rated at 2,500 A at 400 V, but only a circuit-breaker of 300 A at 3,300 V.

Low-voltage distribution gear was usually of the totally enclosed ironclad "unit" type. But for d.c. the flat-back board with air break circuit-breakers was still popular, and ironclad d.c. boards were also available. Switchboards incorporating draw-out oil breakers of 1,500 A represented the upper limit of size; 40-A and 15-A breakers were in common use and 15-A breakers had been installed for normal full-load currents as small as 0.25 A. With circuit-breakers below 300 A in capacity double and triple tier switchboard construction was practicable. The power consumption in some buildings might exceed 1,000 kW and fully justified circuit-breaker control.

An alternative form of l.v. distribution switchboard used switch-fuses (a knife switch and set of fuses in a common case) or fuse-switches (the fuses acting as the switch blades) a number of 30-A elements being used in parallel for the higher ratings. High rupturing capacity fuses were of two types, wired with (*a*) low resistance high melting element such as silver and (*b*) a copper element having a centre section for low melting and of relatively high resistance such as tin alloy.

Hand-operated motor starters had the advantages of simplicity and robustness. Semi-automatic starters limited operation to the pressing of a push-button, but needed rather more maintenance of a higher order. Completely automatic control was provided for duties that were inherently unsuitable for manual operation. A 50-h.p. d.c. panel cost 50 per cent. more than the equivalent hand starter, the net weights being in the same ratio.

Motor control protective features should include an isolator, which must be conveniently placed and electrically interlocked. The overload release of the solenoid or magnetic clapper, thermal bimetallic strip or solder pot, or inductive relay types should have a time delay device. When solenoid releases were operated from current transformers delay could conveniently be obtained by shunting the tripping coil with a fuse. Thermal releases had an inherent time lag and could be combined with solenoid releases arranged for instantaneous operation under short-circuit conditions.

The oil dash-pot was the most widely used device for obtaining time delay. The increasing use of squirrel-cage motors had brought into being a two-rate time lag device to differentiate between starting and running conditions by means of a valve which automatically closed during the accelerating period and opened after the current had fallen to the normal running value. A low-voltage release to ensure the return of the starter to the "off" position as a preliminary to restarting was also necessary.

The squirrel-cage motor predominated because it was cheaper, had no brushgear, and required the minimum of switchgear. Two, three and four speeds were obtainable by various combinations of stator windings, which, however, increased the cost of the motor and its control gear.

The minimum of switchgear was needed for "direct to line" starting, which practice was increasing; l.v. switchgear was in service controlling 200- and 300-h.p. motors in this way and the same practice had been adopted in South Africa on a 2,000-V system. When the heavy starting current involved in direct switching was likely to affect the voltage regulation of the distribution system, alternatives were available in the form of star-delta or auto-transformer starters, which were made for hand or electrical operation, either air break or oil immersed.

For speed regulation wound rotor motors remained indispensable. Their starting gear comprised a stator circuit-breaker forming part of a switchboard and interlocked with a rotor starter adjacent to the motor. The face-plate type was quite satisfactory and for frequent changes of speed a drum type

might be employed, the speed-step regulating resistances being dispensed with in the case of very large motors by using a liquid starter. Automatic actuation could be provided by push-button contactors.

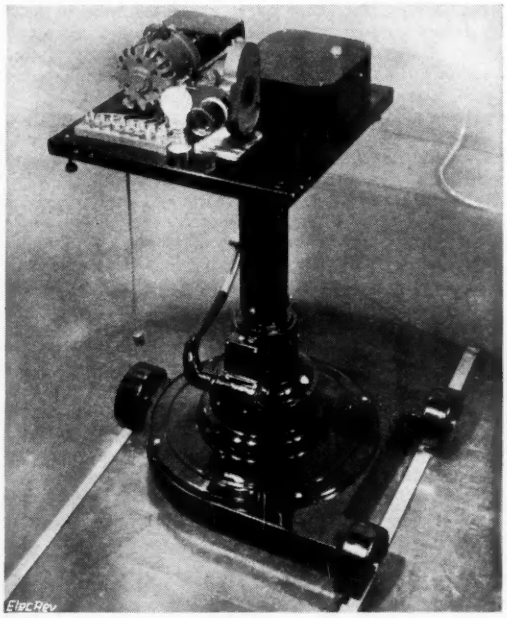
The three-phase commutator motor was sometimes used as the alternative to a slip-ring induction machine when speed reduction was required over long periods. Its control gear consisted of a circuit-breaker interlocked with brush-shifting gear, the latter being moved by hand or auxiliary motors for automatic service.

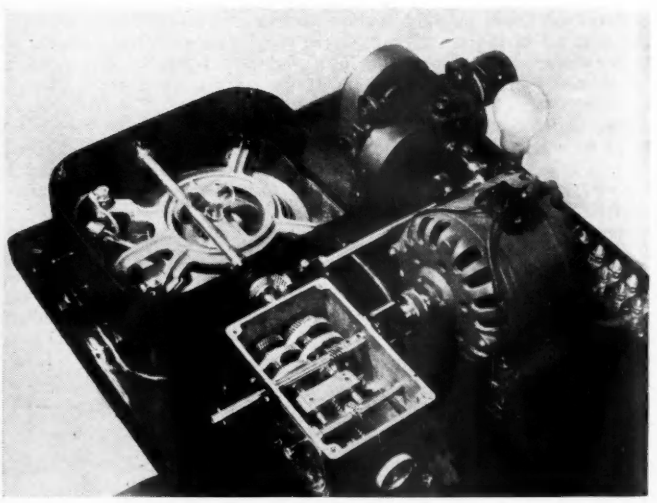
* * *

Cine-radiography

APPARATUS for obtaining cinematographic picture records of the movements of parts of the human body as revealed by X-rays was demonstrated and described in a paper by DR. R. J. REYNOLDS at the INSTITUTION OF ELECTRICAL ENGINEERS in London on March 19th. Many modern workers hold views quite opposite to the author's and believe in the future of the direct method. Dr. Reynolds chose the indirect system, since he considers it likely to be the cheaper in the end, more convenient, and more effective to use in practice.

The X-ray outfit, though more powerful, is of the ordinary type and can be employed for normal radiography. The X-ray image is photographed direct by the camera without the aid of light other than the fluorescence of the X-ray screen, which is of a special intensifying Ilford type emitting a blueish fluorescence. It has a slight afterglow, which is partially counteracted by shining red light on it. The 16-mm. camera film is a special Ilford type coated with X-ray emulsion. The special Zeiss lens of f/0.85 aperture covers a screen image of 10 by 18 in. at a fixed focus distance of 63 in., though the distance of the X-ray tube anti-cathode from the screen varies.





Complete cinematographic X-ray camera outfit on adjustable pedestal, with (below) close-up view of camera, infra-red lamp, driving motor, gear box and rotary synchronising disc switch for circuit breaking

The tube current is 60 mA at a maximum of 120 kV. The rays are filtered through aluminium to intercept the "soft" radiations, which might otherwise burn the patient's skin. This is normal radiological practice, but the screen has no lead glass over it, while the camera is protected by a shield of lead to prevent the X-rays from fogging the film.

To obtain a sufficiently long exposure without subjecting the patient to over-irradiation or putting a destructive strain on the X-ray tube the rays are emitted only during the instant while the camera shutter is open. This is effected by an oil-immersed rotary disc switch that synchronises the camera driving motor with a primary (X-ray input transformer) circuit-breaker. This ensures that the patient only receives half the radiation that he would otherwise be exposed to. The camera frame speed can be varied in sub-multiples of 50 (the motor frequency), complete synchronism being meanwhile maintained by a special gear box. Also, the period of time during which each individual frame is subjected to fluorescent screen light corresponds exactly to a given number of a.c. impulses, to ensure that each frame receives exactly the same exposure.

The commercial outfit is made by Messrs. Watson & Sons (Electro-Medical), Ltd. The standard 16-mm. camera is mounted on a vertical ram so that its height can be adjusted by an oil pump actuated by a foot pedal. The camera may also be rotated to serve more than one X-ray outfit. The whole of the switching gear for the camera is included in the X-ray control table, so that the sequence of events is actuated automatically.

The paper also outlines the author's experimental efforts to incorporate in a cinematographic record of the heart beat a synchronous tracing of the electrical output of the heart as recorded by electrocardiographs of the Cambridge electromagnetic and Cossor-Robertson cathode-ray types. The cardiograph light spot is focused on to the X-ray fluorescent screen so that its undulant movement across the screen is photographed on the cinema camera film simultaneously with the movement of the heart. Special precautions are necessary to earth and screen electrically both the patient and apparatus.

The author considers that sound-film records of the heart beat, respiration, and speech, and ionograph records of the local thickness of the heart muscle promise to provide valuable assistance.

* * *

Electricity in Waterworks

In a paper by Mr. W. H. AUSTIN that was read before the London Students' Section of the INSTITUTION OF ELECTRICAL ENGINEERS on March 13th it is shown that for operating pumping plants up to 100 water horse-power, where the requirements can be met by automatic control, electrical power purchased from a public supply authority gives the lowest overall cost. For larger pumping plant the price of electricity must be of the order of 0.5d. per kWh in order to compete with steam driven or oil driven machinery. Electrically driven pumping machinery may be of either the reciprocating or centrifugal type. For larger powers the former type, though higher in initial cost, is the better proposition from both the points of view of running cost and expectation of life. The modern tendency is to use centrifugal pumps; though cheaper to install they are less efficient in the first instance and deteriorate more quickly. Water sterilisation by pre-ammoniation and chlorination involves a cost of about 2s. 6d. per million gallons for both capital and working charges. For ozonisation the cost is of the order of £1 per million gallons, depending on the cost of electrical power and on other factors. The cost of sterilisation is not, however, a large part of the total cost of water preparation, and the additional cost of ozonisation is usually justified by its advantages over the other methods. The audible water-level indicator for transmitting readings *via* the telephone system is described; an electrical method of recoating water mains *in situ* is also dealt with. The paper contains a few notes on the effects of stray electric currents, which not only cause the failure of mains by electrolysis, but also impart an unpleasant taste to the water.

* * *

Transport Papers

The annual joint meeting of the Midland local branches of the INSTITUTIONS OF CIVIL, MECHANICAL and ELECTRICAL ENGINEERS took place at Birmingham on March 18th. The subject discussed was "The Trend of Transport," and among the six opening addresses, two on behalf of each of the three Institutions, was one on "Traction on Roads" by Mr. C. O. Silvers, of the Wolverhampton Transport Department, and another on "Electric Traction" by Mr. E. T. Hippisley (B.T.H.).

Correspondence

Contributions from readers are welcomed. The writer should give his name and address, not necessarily for publication

High-voltage Cable Development

In his recent address as chairman of the North-Eastern Centre of the I.E.E., Mr. Winfield stated that the high-pressure gas cable was invented by Dr. Hochstadter, but while Dr. Hochstadter did valuable work on high-voltage cable design, we do not owe the gas cable to him, as it was invented and patented in the United States by Fisher & Atkinson (U.S. Specification No. 1651590, December 6th, 1927).

After a preliminary statement of the principles of cable design, the patentees point out that bubbles of air or gas may be incorporated in the cable and that these lead to leakage and other trouble through ionisation where the voltage is high enough to produce this effect. They overcome the trouble by putting the gas under a pressure sufficient to prevent ionisation, which pressure may exceed two atmospheres. However, they recommend a pressure of 40 to 100 lb. per sq. in., which decreases dielectric leakage to a marked degree.

As it is no longer necessary to remove every trace of air, cables may even be made with dry cores insulated with dry paper. The method is applicable to cables more or less completely filled with insulating compound applied in liquid or plastic form or to cables whose insulation consists of blocks of solid compound with filled or unfilled spaces between. The insulation may be applied in liquid form and allowed to solidify afterwards, or it may be of a graded type. The sheathing of the cable may be strengthened by various methods to stand up to the pressure, and apparatus may be provided for maintaining the pressure.

As Mr. P. V. Hunter has pointed out, the specification sets forth in great detail the directions in which high-voltage gas cables may be developed in the future, and it is evident that the inventors have produced an invention of extraordinary merit. From another point of view, the disclosure is so thorough that it will be impossible for any other inventor to obtain a master patent, so that the general process is now open to the industry.

One may compare this solution of the problem with Langmuir's method of dealing with the blackening from which electric lamps suffered when he started his investigations. Experts were then agreed that the cure lay in obtaining a perfect vacuum, but Langmuir decided to fill the lamp with a suitable gas, which turned out to be the better method. The transference of ideas from one department is often of great utility, even where it does not appear to be promising at first sight, as in the case of the gas-filled cable. Inventors will do well to read over Fisher & Atkinson's specification with care before filing applications for patents for improvements in gas-filled cables, as they will find that many promising improvements have been so outlined that it will be difficult to obtain adequate protection for the many apparently new ideas. C. TURNBULL.

Tynemouth, *March 16th.*

Professional Incomes

Your correspondent, Mr. J. N. Scaife, asks why the medical profession should be about "four times as capable of looking after its interests as those engaged in electrical engineering." I submit two reasons:

(1) The medical profession rigidly enforces a minimum standard of professional qualification. Nobody can call himself a physician unless he *is* a physician, but anybody can call himself an engineer.

(2) The British Medical Association is reputed to be the strongest trade union in the world.

If only engineers would do for themselves what the medical fraternity has done, they might command equal rewards in the labour market. The remedy is in their hands.

March 12th. SELF-HELP.

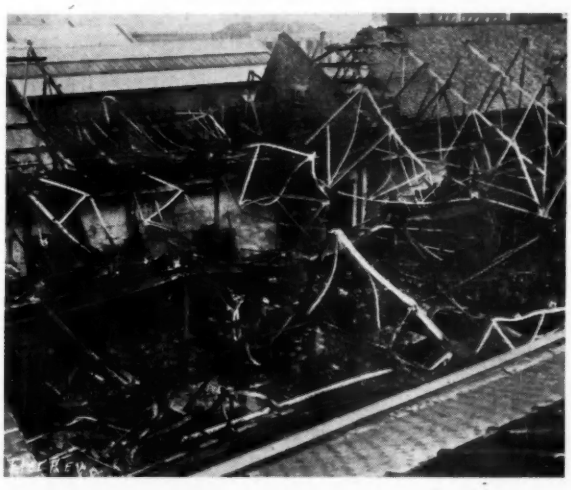
Cables Across the Andes

On page 140 of your issue of January 24th you quote from the *Telegraph & Telephone Age* that "the world's highest telegraph and telephone cables are those recently laid across the Andes from Chile to Argentina.

So long ago as 1905 we ourselves manufactured and later installed and jointed 90 miles of armoured telegraph cables for the Central and South American Telegraph Company. As we do not know at what height our 1905 cables were installed, we cannot say whether the altitude was greater than that of the ones recently laid; but we have evidence that ours were laid from Rio Blanca to Punto Vacus across the intervening Cumbre mountain, which is one of the chain in the Andes forming the boundary. The cable was supplied in 264-yard lengths, and each length was made into a double coil of 132 yards with a bight, so that each coil could be laid separately across the back of a mule.

The work was commenced in the Chilean side by transporting the cable by ox wagon from Valparaiso to Rio Blanca, where it was deposited in a store and carried on mule back to the jointers as they worked their way from Rio Blanca towards the Cumbre mountain. On the Argentine side the cable was taken by rail from Buenos Aires to Punto Vacus, placed in a store and carried on mule back to the jointers in the same way as described above.

The work could be carried on only for about six months of the year, *i.e.*, from October to April. For the remainder of the time the weather conditions were so severe that the passes were closed. The cable had to be laid over part of the route in solid rock, the excavating being done with the assistance of dynamite. A further difficulty to contend with was in getting



There was an outbreak of fire at the Cricklewood factory of the Western Electric Co., Ltd., on Friday last week. Our photograph shows some of the damage which was caused in the two hours during which the fire continued

sufficient labour to carry on the work as the Chileans and Spaniards were loth to take up any work under conditions entailing hardship.

In covering the route laid down several minor rivers had to be crossed, but owing to the proximity of the mountain it was impossible to lay the cable across the bed of these rivers on account of the enormous swiftness of the currents. Iron poles were erected on each river bank, the cable carried up inside the poles and supported overhead across the rivers on a stay wire. W. T. HENLEY'S TELEGRAPH WORKS CO., LTD.

London, E.C.1, *March 13th.* W. A. Moore.

Automatic Cooker Control

Referring to my remarks published in a slightly contracted form in the ELECTRICAL REVIEW of March 6th, the contraction, which I believe was due to pressure on space, has caused the two main purposes of my remarks to be obscured. They were:

(1) To point out that my remarks were based on personal experience in my own home, the cooker being used by persons having no special cookery training, my outside experience merely confirming my home experience. In my home I have had at various times three different models of electric cookers.

(2) To set out the circumstances attending gas and electric cooking so that the essential differences would be noted and the thermostat for electric cooking be discovered to be a luxury, not a necessity, as it is with a gas cooker.

The first of the letters under this heading in the current issue of the REVIEW shows that these objects have not been realised, and I feel that some expansion of my published remarks where they refer to the above objects would be of interest to my fellow readers. H. G. BATSON, Assoc. I.E.E.

Worcester, *March 15th.*

The Belfast Association of Engineers

The report of this Association's annual dinner in our last issue was, by a printer's error, headed "The Belfast Association of England." For this we ask the pardon of our Northern Ireland friends.

The Broadcasting Committee's Report

THE report of the Broadcasting Committee, which was appointed by the then Postmaster-General in April, 1935, was presented to Parliament on Monday (H.M. Stationery Office, Cmd. 5091, 1s. 3d. net.). The Committee, under the chairmanship of Viscount Ullswater, held thirty-five meetings and examined seventy-nine witnesses, besides numerous memoranda. Briefly, the terms of reference were to consider the constitution, control and finance and to advise generally on the conditions under which the service should be conducted after December 31st, 1936, when the present charter of the B.B.C. expires.

Unanimous endorsement of the B.B.C.'s general policy and activities is expressed in the report, which recognises that the constitution of the Corporation has worked well and has served as a model elsewhere. The Committee's desire is to secure and strengthen the position already attained.

Very few technical aspects have been considered; the achievements of the Engineering Division are not even mentioned. The summary of recommendations states, *inter alia*, that, in view of the widespread approval of the broadcasting service in this country, in which the Committee concurs, the charter of the B.B.C. should be extended for ten years from January 1st, 1937. The number of governors should be increased to seven and their salaries raised. They should be nominated by the Crown on the recommendation of the Prime Minister for a normal term of five years, and a retiring governor should not be renominated. Wales should be constituted a distinct broadcasting region, but the suggestion that a separate Welsh Broadcasting Corporation should be set up with an independent charter is rejected.

Minor issues, domestic policy and day-to-day management should be left to the free judgment of the B.B.C. The Minister responsible in respect of broad questions of policy and culture should be a selected Cabinet Minister in the House of Commons, free from heavy departmental responsibilities and preferably a senior member of the Government. This Minister should have the right of veto over programmes, and the duty of "defending" the broadcasting estimates in Parliament; but technical control should remain with the Postmaster-General.

Financial Aspects

The licence fee should remain at 10s. per year. The share of licence revenue allocated to the Post Office should be a percentage to cover costs, reviewed every two years. The share of the remaining net revenue to be allocated to the B.B.C. (for purposes other than television) should be not less than 75 per cent. of current receipts. The balance should be regarded as potentially available for the needs of broadcasting and when all needs have been met any surplus remaining may equitably be assigned to the State. The Exchequer share for the year 1936 should be limited to £1,050,000, exclusive of income-tax payable by the B.B.C. (on capital and reserves). Capital expenditure should be defrayed from surpluses of revenue over current expenditure, but the limit of short-term borrowing might be raised to £1,000,000.

The Committee is satisfied with the value of school broadcasting and in its opinion receiving equipment should come to be regarded as part of the normal equipment of every school. It is recommended that one or more types of receiving set for use in schools might be specially designed, ordered in quantity by local education authorities, and manufactured at a low price. The Empire service, inaugurated in December, 1932, should be expressly authorised, fostered and developed; the appropriate use of languages other than English should be encouraged for this service.

Broadcast television should be expressly authorised and its finance for two years ahead should be reconsidered by the Television Advisory Committee in the autumn of 1936. This service should have a claim upon a proportion of the surplus remaining after deduction of 75 per cent. of the net revenue from broadcast receiving licences. The cost of providing the proposed London television station and a service therefrom up to December, 1936, is estimated to be £180,000.

Relay Exchange Ownership

It is recommended that the ownership and operation of relay exchanges and the technical development of wire broadcasting in general should be undertaken by the Post Office, and the control of relayed programmes by the B.B.C. The first exchanges of this kind were licensed by the Post Office in 1927; five years ago there were about 60 with 14,000 subscribers, while there are now approximately 340 exchanges with more than 200,000 subscribers.

All the licences are terminable in December, 1936, when the Postmaster-General may require the licensee to sell to him such portions of the plant and apparatus as he may specify at a price "equal to the value thereof at the date of purchase as plant and apparatus *in situ*, exclusive of any allowance or compensation for loss of profit, compulsory sale, goodwill, the cost of rising capital, or any other consideration."

The Committee recognises a considerable public value in the system, but it points out that private ownership results in the provision of service only where conditions are most favourable for making a profit. Also, the Committee had evidence from many quarters that the proprietors of relay exchanges are in a position materially to damage the B.B.C.'s programme policy by relaying a large proportion of material from foreign sources and selecting parts of the B.B.C. programmes and omitting others, so upsetting the balance upon which B.B.C. programmes are constructed and by one-sided selection lowering the level and lessening the impartiality of the service.

Private ownership involves the provision of extensive wiring networks, duplicating the telephone network, but unco-ordinated with it. The report states that there is a prospect of future distribution by trunk lines from the B.B.C. stations to relay centres, with advantages in improved quality and the avoidance of fading and interference. Such trunk lines should clearly, the Committee says, be part of the telephone system and associated with the trunk lines at present set apart for B.B.C. use. There is also a prospect of the future local distribution of broadcast programmes over the telephone system itself by means of high-frequency carrier currents, which could convey two or more alternative programmes without in any way interfering with the normal use of the telephone.

The Committee has heard evidence, too, of possible distribution by similar means over electric light and power mains, but it sees no good purpose in the independent development of these various methods by wire. It considers that the time has come for unification and co-ordination by the Post Office.

Reception Recommendations

The report recommends that the technical investigation of electrical interference with broadcast reception should be expedited and compulsory limiting powers sought if necessary. The Post Office investigates as many as 40,000 complaints in one year, and in a growing number of instances (about 24,000 at present) faulty reception is in fact due to such interference.

Usually, the appropriate remedy can be applied either to the interfering appliance at the expense of its owner, or to the radio receiving set at the expense of the listener. The cost ranges from 5s. to £1, but in the case of certain special kinds of electrical apparatus the application of corrective measures may cost £20 or even £50. In about 4,000 cases per year, when the listener for his part has no effective remedy, the owner or user of the offending apparatus declines to take action or to incur the necessary expenditure to reduce interference.

The report states that the average price of a broadcast receiving set of medium quality in this country is somewhat high. It suggests that the B.B.C. and the trade should jointly examine the possibility of designing and putting on the market, at a low fixed price, a standard receiving set.

Local authorities are recommended to obtain powers (in the Home Office approved form of by-law) to deal with annoyance caused by the persistent misuse of loud speakers.

Minority Proposals

Reservations by some members of the Committee to certain portions of the report include the suggestion by Major C. R. Attlee, M.P., Lord Elton, and Mr. E. Clement Davies, K.C., M.P., that a "weak spot" in broadcasting is in the provision of receiving sets by private industry. They propose that the B.B.C. or, preferably, the Post Office, should manufacture receiving sets and supply them to the public. Sir William McLintock does not think it advisable that the B.B.C.'s hands should be tied in making its arrangements for future capital expenditure by having to submit schemes to Parliament before embarking upon them. Lord Selsdon disagrees with the conclusions and recommendations that the ownership and operation of existing relay exchanges should forthwith be transferred to the Post Office. He recommends that the licensing system should be continued for audio-frequency relay exchanges for two years from December, 1936, and that future licences should be granted only up to December, 1938. He considers that future development of this system will probably be on high-frequency rather than audio-frequency lines and, moreover, that others than telephone subscribers should be able to benefit from a service of this kind.

The Board of Governors of the B.B.C. has officially issued "observations" on the report, mostly explanatory. The report is now being considered by the Government.

New Apparatus and Devices

for Domestic, Cooking and Heating, Lighting, Power and Scientific Purposes

An Omni-directional Wall Bracket

A novel type of detachable swinging all-directional wall bracket has been designed by the "TYPERLITE" COMPANY, 86, Cannon Street, London, E.C.4. Its overall length is 60 in. and it is fitted with three specially designed friction joints, by means of which the intervening square rods can be made to remain in a vertical direction at any desired angle. The head of the bracket consists of an 18 in. reinforced metal flexible tube fitted with a lamp-holder and knuckle joint.

A "Typerlite" wall bracket

The end of the bracket nearest the backplate is designed in such a manner that it can be instantaneously detached in one position only from its spindle.

A number of these units have been supplied to an electricity supply company for the illumination of large banks of meters undergoing tests, as the light can be directed on any meter index situated within a range of 5 ft. from the backplate.

A Two-piece Plug Adaptor

A low-priced yet well-made two-piece bakelite plug adaptor for radio sets, vacuum cleaners and other domestic appliances is a new "Clix" product made by LECTROLINX, LTD., 79A, Rochester Row, Westminster, London, S.W.1. The top half comprises a bayonet plug with a two-pin socket in the base, while the lower portion consists of a two-pin plug, the two parts being connected by a piece of cord.

A "Clix" two-piece plug-adaptor

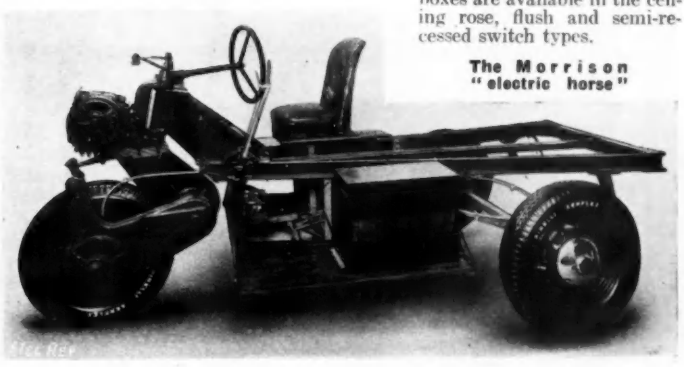
Colour-sprayed Decoration Lamp

A new series of "Osram" colour-sprayed decoration lamps has just been introduced by the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2. The lamps are rated at 15 W and are designed for use on 200-260-V. Such lamps are specially suitable for occasional decoration schemes for which it would be uneconomical to use standard sign lamps, such as seaside decorations and for installation in connection with fêtes, exhibitions, band stands, tea gardens, bathing pools, road houses, &c. The standard colours are white, yellow, green, orange, pink, red, blue and flame tint and, as the colours are sprayed inside, they are as permanent as natural coloured glass. The lamps are available with b.c. or e.s. caps. A 14-V. 7-W range of the same type of lamp, with s.e.s. or s.b.c. caps, can also be supplied. These lamps are externally sprayed.

The Morrison "Electric Horse"

An interesting exhibit at the British Industries Fair was the new Morrison "electric horse" with one front and two rear wheels.

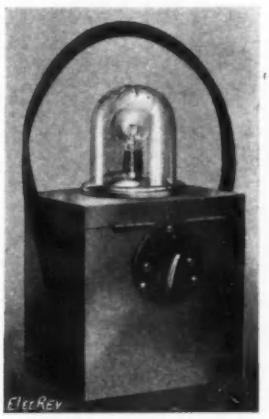
A forked adaptor attached to the spindle head is incorporated to carry the motor. The drive from the motor is unique, as can be seen from the accompanying photograph (reproduced by courtesy of *Motor Transport*). A triple ¾-in. pitch chain drives downward to a cross-over shaft behind the front wheel. From this point a triple ½-in. pitch chain drives the front wheel, the total reduction being 9.5 to 1. This arrangement allows the front wheel to move up and down against road shocks. Depression of the foot pedal in a normal manner changes each speed of the vehicle in the usual way. Violent depression, however, does not increase the speed of change at the same rate, as the controller is given a predetermined time lag on each speed. This obviates drive snatch and jerk and saves transmission damage. Reversing gear is included, and the batteries are mounted in brackets extended outward on both sides of the chassis. Three models are available, to take 6 cwt., 10/15 cwt. and 30 cwt. The makers, MESSRS. A. E. MORRISON & SONS, LTD., Gartree Street, Leicester, claim that the largest size can be run for £55 per year, including depreciation. All models are available on hire, the smallest costing 30s. per week, including tax, insurance, &c.



The Morrison "electric horse"

An Alkaline Battery Handlamp

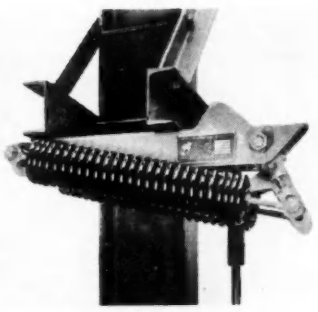
In response to requests from fire-brigade superintendents, BATTERIES, LTD., Hunt End Works, Redditch, have placed on the market a new model hand-lamp fitted with the "Nife" nickel-cadmium alkaline accumulator. A very strong glass globe of heavy section is mounted on a hardwood case finished in red cellulose enamel. This globe protects a 4-V, 8-W lamp, which gives a good dispersive light. The steel-plate accumulator is housed in a hardwood case and is of sufficient capacity to provide four hours' continuous light on one charge. The weight of the complete lamp is only 9 lb., and the measurements are 5½ in. by 7 in. by 10 in. high.



The "Nife" nickel alkaline battery handlamp

High-temperature Pipe Supports

The "Babcock-Genspring" constant support is designed to enable piping that is subjected to vertical movement, due to expansion and contraction, to move freely in any direction, thus obviating back-thrust with consequent leakage or failure of joints. The support compensates for variations in spring tension irrespective of pipe movement, and is applicable to all kinds of high-temperature equipment, including heat exchangers, furnace walls or condensers. The standard range of load is from 500 to 7,500 lb. and 2-in. vertical travel, but other requirements can be met. The capacity may be adjusted by bolts to ±20 per cent. or normal load. The pivot pins are of stainless steel and the springs are protected by a rust-resisting asphaltum enamel. A safety stop holds the load in the event of spring failure. Where extreme vibration occurs an adjustable washer-friction damper is provided. The support, which is manufactured by MESSRS. BABCOCK & WILCOX, LTD., Farringdon Street, E.C.4, is supplied as a unit complete with turnbuckle, screwed with right-hand thread to suit the user's sling rods.



The "Babcock-Genspring" pipe support

Lug Grip Switch-boxes

We are informed that MESSRS. FITTER & POULTON, LTD., Vincent Parade, Balsall Heath, Birmingham, 12, are now manufacturing pressed-steel lug grip boxes to take semi-recessed switches. There are no sharp projections and cables may be drawn in without damage, a feature which is patented. The tube enters the lug ¾ in.; the lug is then reduced in size and gives a straight entry for the cables, which are not frayed against the end of the tube. Continuity is ensured between the lugs and the box by an electrical weld. The boxes are available in the ceiling rose, flush and semi-recessed switch types.

Recent Electric Fire Developments

Some new designs described

DURING the past month or two several new electric fires have been introduced. Beginning with the low-priced models, there is the "Handy-Ray" (BELLING & Co., LTD., Southbury Road, Enfield), a light construction reflector fire in antique silver with a horizontal rod type element in front of a chromium-plated parabolic reflector. A special feature is that it weighs only 3½ lb. The stand is so designed that the fire can be laid on its back for heating a saucepan or kettle on the guard, while an extra attachment enables it to be fixed to the wall.

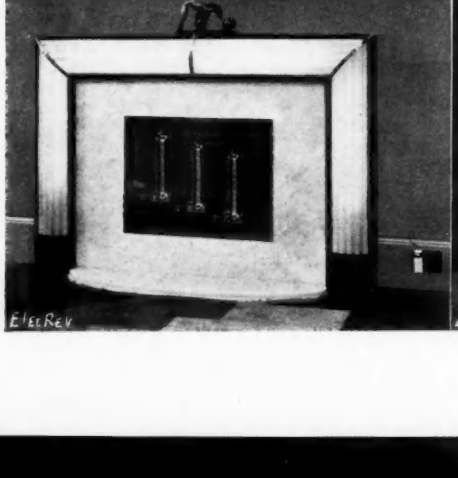
The Bank model "E.C.1"

The 1-kW "Parabeam" fire (PREMIER ELECTRIC HEATERS, LTD., Keeley Street, Birmingham, 9) has already been described, and has proved itself so popular that a 2-kW size of this type has been added. A new kind of cast-iron fire, finished in "Kolcraft" florentine ivory and gold is the 750-W "Parabain" bathroom fire, designed for wall mounting with a hanging cord adjustment for the chromium-plated reflector.

Among a range of electric fires incorporated in fireplaces made by Messrs. JAMES SMELLIE, LTD., Oxford Street, Dudley, is the No. 4432 with a stainless steel surround. The standard size is 30 in. by 30 in. by 4 in., but as it is made by hand it can be supplied in any size to order and with 1-, 2-, 3- or 4-kW elements. An advantage of the stainless steel surround, of course, is that metal polish can be used for cleaning without ill-effects.

Several interesting modern fireplaces have been introduced lately by Messrs. W. N. FROY and SONS, LTD., Brunswick Works, King Street, Hammersmith, London, W.6, including the model I.H.10 which has provision for books, a clock and radio. The materials of the mantel are oak, ebonized mahogany and chromium plated shelf pillars. The front of the 2 kW chromium plated fire is in orange varois marble. A striking design is the lighted mantel model N.D.48. In this example a Corning-Steuben glass architrave, white satin finished, is chosen to illuminate a surround of Algerian onyx and contrasts with the rustless steel and walnut. The fire has a loading of 3 kW, the elements being arranged vertically.

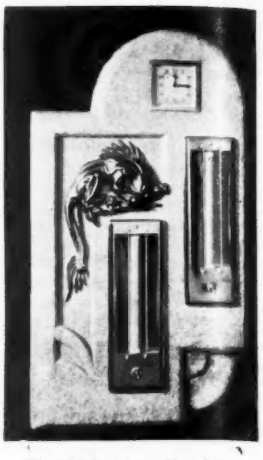
The electric fireplaces of Messrs. TABARD, LTD., 16, Station Approach, Clapham Junction, London, S.W.11, are luxuriously designed in many modern styles, some of which can be seen at the Building Centre, London. The designs include fireplaces incorporating bookcases, radio receivers, clocks and mirrors. There are several small wall plaques in stone decorated with various carved motifs. Both Bath and Portland stone are used, a typical example being model C.S.14, in chromium or bronze finish, with two 1-kW vertical elements.



Another unusual design is the illuminated pillar fire which is being made by Messrs. T. WINSTON, 82, Ryland Road, Birmingham. The pillars on each side of the elements are illuminated in orange.

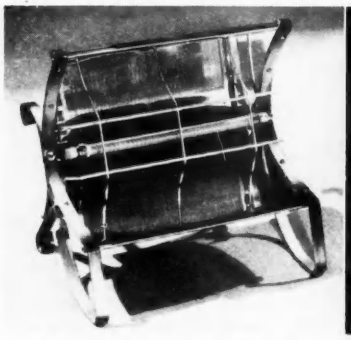
We are informed by the BRITISH TRANE Co., Vectair House, Newcastle Place, London, E.C.1, that its "Vectair" low temperature convectors are now available with an adjustable thermostat. The glass scale and pointer are illuminated by a small neon lamp.

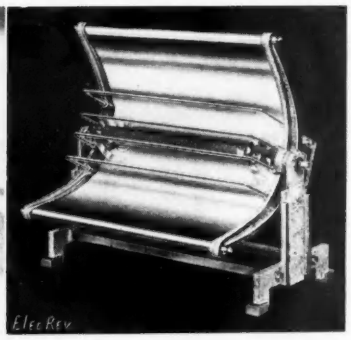
There are several new models made by the "BANK" HARDWARE MANUFACTURING Co., LTD., Whittimere Street, Walsall. A note of originality is struck by the "E.C.1," which, besides being an electric fire, is also a hearth set for a coal fire, the poker, spring tongs, brush and shovel being carried on a good quality stand. The element has a ¾ kW loading. There are also screen fires. A newcomer is the "E.V.3," a low-priced model finished in silver and black and obtainable with elements rated at ¾ kW or 1½ kW. There are also an inset fire and a cast portable fire, both available with 1 or 2 kW elements. A recent general improvement is the fitting of the new "Kanthal D" elements instead of using nichrome wire.



The Tabard wall plaque No. C.S.14

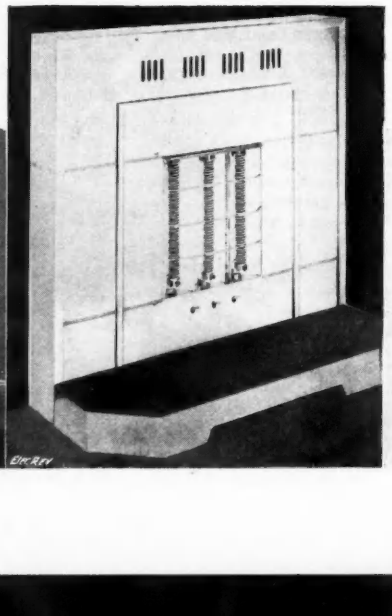
Another concern which has recently brought out a number of new designs is the CARRON COMPANY, Carron, Falkirk. They are of the sheet-metal panel and inset types. No. 503 is a 2-kW inset fire measuring 14 in. high by 8½ in. wide, with a projection of 1¼ in. and finished in chromium plate. Type 504 inset fire is available with a loading of either 1 or 2 kW and two finishes are available, namely, "Carrontine" lacquer or chromium plate. The same finishes, with the addition of vitreous enamel, are applied to the No. 525 panel fire for wall fixing. This is also available in 1- and 2-kW sizes and is slightly larger in size than the inset type.





The Belling "Handy Ray" and the Premier 2-kW "Parabeam"

A panel fire has also been added to the range of "R.E.A.L." fires made by Messrs. ROWLANDS ELECTRICAL ACCESSORIES, LTD., R.E.A.L. Works, Hockley Hill, Birmingham. It is so designed that it can be fitted immediately to the wall without any cutting away; the projection is then only 2 in. Double ventilation, behind the elements and through the panel, is incorporated, and the new "superposed" elements are fitted horizontally in refractory material. Double-pole switches are standard on both the 1- and 2-kW sizes, and heat-proof enamel is used for finishing the fire. The fires are 16½ in. by 13¼ in. and 16½ in. square respectively, the 2-kW size having independently controlled elements.



Left: The Froy illuminated mantel-fireplace. Centre: A stainless steel fireplace by James Smellie, Ltd. Below: The Winston illuminated pillar fire

British Overseas Electrical Trade

Exports resume upward trend

In February our electrical exports attained a value of £1,148,385, which is higher than for any corresponding month since 1930. There was, of course, an extra day due to Leap Year, but when this is taken into account the increase of £128,240 (13 per cent.), compared with February, 1935, still represents an improvement in the daily average. These figures should allay fears that the small, but disturbing, decline in exports during January indicated that the peak of the upward trend had been reached. Indeed, the February rise more than cancels the falling-off in the previous month, the total value of exports so far this year (£2,329,361) being £118,239, or 5 per cent., above the figures for the corresponding period of 1935.

The accompanying smaller table, compiled from figures abstracted from the Board of Trade returns for the month, shows that the expansion extended to the majority of classifications, the machinery items being particularly encouraging. Exports of electric motors rose by £37,333 (46 per cent.), switchgear by £26,119 (33 per cent.), and convertors and transformers by £22,886 (52 per cent.). Altogether, machinery shipments amounted in value to £422,232; this amount was exceeded in only one month last year, namely, November, and was £96,859 (30 per cent.) more than in February, 1935. By referring to the second table we see that the largest additional shipments went to South Africa (+£36,701 in motors and +£20,753 in unenumerated electrical machinery). The value of electric generators sent to this market, however, declined by £19,114, this being compensated for by an increase of £19,567 in exports to Canada—an unusually large amount for this Dominion—while shipments to British India increased by £11,695 to £19,305.

Some months ago we mentioned the possibility of electrical machinery being required to meet the development in Malaya. This country is not classified separately for the larger items of plant, but the following figures for the past few months under "other machinery" are significant:—October, £2,988; November, £4,884; December, £6,132; January, £7,493; and February, £11,698.

Turning to goods, it is seen that telegraph and telephone apparatus exports at £108,038, remained above the amount for February, 1935, although in recent months shipments have been up to as much as £200,000. The chief destinations of such exports (with comparative figures for February, 1935) were as follows:—South Africa, £24,737 (£22,155); Australia, £20,154 (£9,421); Argentina, £15,872 (£5,529); Canada, £1,300 (£465); other foreign countries, £31,308 (£52,516); other British countries, £14,667 (£16,356).

Apart from the telegraph and telegraph type, exports of wires and cables were very satisfactory, the values for the chief countries (February, 1935, figures in parentheses) being as follows:—

Rubber-insulated wires and cables.—Australia, £32,410 (£20,502); South Africa, £21,805 (£18,378); British India, £14,087 (£12,446); New Zealand, £4,892 (£4,194); other British countries, £16,601 (£10,093); foreign countries, £10,290 (£10,377).

Electric wires and cables (insulation other than rubber).—South Africa, £33,642 (£31,523); British India, £17,512 (£18,881); Australia, £15,441 (£7,341); other British countries, £15,703 (£13,573); various foreign countries, £11,758 (£13,997).

Imports during February amounted to £290,755, which is £46,432 (19 per cent.) more than in the corresponding month of last year, but is lower than for several months past. It is noteworthy that imports of vacuum cleaners, which have been high lately, were lower last month, Sweden being the supplier most affected, as is shown in the following analyses of the sources from which electrical goods and vacuum cleaners were received in this country (February, 1935, figures are given in parentheses):—

Imports of electrical goods and apparatus.—Germany, £64,876 (£59,929); Netherlands, £55,032 (£39,696); United States, £53,637 (£43,342); France, £21,413 (£7,417); Switzerland, £18,910 (£10,431); Belgium, £13,147 (£11,597); Austria, £3,942 (£8,163); other foreign countries, £9,842 (£12,109); British countries, £8,232 (£14,660).

Electric vacuum cleaners.—Canada, £3,175 (£3,604); United States, £2,371 (£4,526); Sweden, £950 (£4,356); Germany, £670 (£522); other foreign countries £3,171 (£838).

In the first two months of this year imports have amounted in value to £616,926, or £95,294 (19 per cent.) more than in the corresponding period of last year.

EXPORTS AND IMPORTS DURING FEBRUARY

	Exports. Feb. 1936.	Exports. Inc. or dec. compared with Feb., 1935	Imports. Feb., 1936.	Imports. Inc. or dec. compared with Feb., 1935.
Submarine telegraph and telephone cables	£6,544	– £2,049	*	—
Telegraph and telephone wires and cables (not submarine)	27,790	– 11,294	*	—
Other insulated wires and cables	194,141	+ 32,836	£25,205	+ £5,219
Radio receivers, not radiograms (excluding valves)	24,441	+ 4,983	14,548	– 219
Radio transmitters (excluding valves)	7,134	– 13,066	*	—
Radio valves	30,136	– 8,341	13,282	– 1,826
Other radio parts and accessories	29,805	– 7,469	47,027	+ 8,523
Telegraph and telephone apparatus (other than radio)	108,038	+ 1,596	*	—
Electric carbons	*	—	9,255	– 3,435
Incandescent lamps	51,194	+ 10,300	7,639	+ 706
Other lighting apparatus	36,256	+ 2,603	31,951	+ 10,200
Primary batteries	14,715	+ 1,332	386	+ 71
Accumulators	51,127	+ 14,074	*	—
House service meters	14,702	+ 625	*	—
Other electrical instruments	18,307	+ 525	30,160	+ 11,949
Unenumerated electrical goods and apparatus	111,823	+ 4,726	69,578	+ 10,499
Electric generators up to 200 kW	31,978	+ 6,968	*	—
Electric generators over 200 kW	36,265	+ 2,130	*	—
Electric motors	118,580	+ 37,333	25,356†	+ 8,291
Convertors and transformers	66,649	+ 22,886	*	—
Starting and controlling gear for motors	47,334	– 1,081	*	—
Switchgear	107,655	+ 26,119	*	—
Other electrical machinery	13,771	+ 2,504	6,031	– 7
Electric vacuum cleaners	*	—	10,337	– 3,539
Total	£1,148,385	+ £128,240	£290,755	+ £46,432

* Not classified separately. † Not railway and tramway motors.

BRITISH ELECTRICAL EXPORTS DURING FEBRUARY

Destination.	Goods and apparatus, Feb., 1936.	Inc. or dec. compared with Feb., 1935.	Electric generators, Feb., 1936.	Inc. or dec. compared with Feb., 1935.	Motors, Feb., 1936.	Inc. or dec. compared with Feb., 1935.	Other electrical machinery, Feb., 1936.	Inc. or dec. compared with Feb., 1935.
Irish Free State	£26,732	– £2,002	*	—	*	—	*	—
Channel Islands	8,735	– 1,196	*	—	*	—	*	—
Union of South Africa	136,591	+ 18,515	£15,047	– £19,114	£50,574	+ £36,701	£81,457	+ £20,753
British India	97,931	+ 5,433	19,305	+ 11,695	15,675	+ 4,355	37,788	+ 9,820
British Malaya	19,349	+ 6,126	*	—	*	—	11,698	+ 9,955
Ceylon	8,425	+ 4,695	*	—	*	—	*	—
Hong Kong	15,527	+ 7,474	*	—	*	—	*	—
Australia	108,867	+ 10,301	3,102	+ 1,961	10,856	+ 1,088	16,191	+ 8,368
New Zealand	44,131	+ 10,911	*	—	2,148	+ 271	7,415	– 1,413
Canada	5,621	– 686	19,840	+ 19,567	3,912	+ 431	1,062	– 848
Other British Countries	40,754	+ 1,510	7,401	+ 1,820	13,155	+ 729	22,499	– 6,717
Sweden	10,669	– 10,382	*	—	*	—	*	—
Denmark	12,914	– 919	*	—	*	—	*	—
Netherlands	13,178	– 8,129	136	+ 136	*	—	1,377	+ 499
Belgium	7,692	– 1,834	*	—	*	—	*	—
France	20,773	+ 7,435	*	—	*	—	3,924	– 119
Portugal	4,683	+ 385	*	—	*	—	*	—
Spain	10,965	+ 2,428	*	—	*	—	*	—
Italy	6,367	– 11,089	*	—	*	—	*	—
Greece	1,652	– 1,652	*	—	*	—	*	—
Rumania	986	– 11,691	*	—	*	—	*	—
Egypt	9,543	– 29	*	—	*	—	675	– 746
China	10,492	– 3,601	*	—	*	—	1,297	– 1,476
Brazil	5,208	– 1,235	*	—	*	—	*	—
Argentina	35,794	+ 13,532	*	—	950	– 2,029	2,432	+ 1,294
Soviet Union	*	—	*	—	100	+ 100	*	—
Other Foreign Countries	62,571	– 32,919	3,412	– 6,967	21,210	– 1,313	47,594	+ 11,058
Total	£726,153	+ £31,381	£68,243	+ £9,098	£118,580	+ £37,333	£235,409	+ £50,428

* Not classified separately.

Parliamentary News (BY OUR SPECIAL REPORTER)

A SELECT Committee of the House of Lords presided over by Lord Askwith had under consideration on March 10th the Cornwall Electric Power Bill. The Bill was opposed by Penzance Corporation.

Mr. Craig Henderson, K.C., explaining the Bill on behalf of the promoters, said the operations of the company covered the whole of Cornwall with the exception of two small areas in the northern part of the county. It now asked for power to take over by agreement any authorised undertaking in its area. By absorbing the various undertakings in one company it would effect such economies of administration as would enable it to reduce the price of electricity. The company undertook to reduce the price forthwith by 33 per cent. in the case of industrial charges such as shop lighting, and by 25 per cent. in the case of domestic consumption with certain reductions in the flat rate for lighting. The result would be a saving to the consumers of over £12,000 per annum.

After hearing evidence the committee approved the Bill and it was ordered to be reported for third reading.

The Electricity Commissioners' Staff

In the House of Commons on March 10th Mr. Short asked the Minister of Transport whether he would specify the various grades to which the clerical staffs of the Electricity Commissioners were attached.

Captain Hudson said that they were attached to the Higher Clerical, Clerical, Special Class, and Temporary Clerk grades.

Consolidation of Electricity Supply Law

On March 11th Mr. Smedley Crooke asked the Minister of Transport whether he would consider the possibility of consolidating the law in respect of electricity supply, which was now spread over eleven Acts passed between 1882 and 1935.

Mr. Hore-Belisha said that he would bear the suggestion in mind.

Manchester Railway Electrification

Mr. Ellis Smith asked the Minister of Transport on March 11th if he would hold a public inquiry into the need for the electrification of the railway system within a radius of fifty miles of Manchester.

Mr. Hore-Belisha said he understood that there was to be a further conference shortly between representatives of the railway companies and the local authorities to discuss the development of transport facilities in the Manchester area and he did not think that he could usefully intervene, at any rate, at this stage.

The Bradford Breakdown

On March 11th Sir Arnold Gridley asked the Minister of Transport if he could now say how many hours elapsed before the recent failure of the electricity supply at Bradford terminated with full restoration to all consumers; when an official report would be made public; and how many of the selected stations operated by municipalities and companies, respectively, were dependent on non-duplicated switchgear control, as was apparently the case at Bradford, which made help from the grid impossible.

Mr. Hore-Belisha said that the public inquiry into this matter would be opened on March 24th by Mr. H. Nimmo, the Chief Engineering Inspector to the Electricity Commission. In the meantime he trusted that he might not be pressed to give fragmentary information.

Notts and Derbyshire Electric Traction

The Nottinghamshire and Derbyshire Electric Traction Bill was considered on March 11th by a Select Committee of the House of Lords of which Lord Askwith was chairman. By this Bill the company seeks power to run trolley vehicles on a new route, and the Bill was opposed by the Trent Motor Traction Company, which objected to the promoters as a statutory company being given the right to apply in the same way as a limited liability company for licences to run omnibuses. After hearing Mr. Craig Henderson, K.C., for the opponents, the committee approved the Bill.

The Electricity Supply (Meters) Bill

This Bill to which reference was made last week passed through Committee and was read a third time in the House of Commons on March 12th.

Wireless Licences

Mr. McEntee asked the Postmaster-General on March 16th whether, in view of the large increase in the number of persons holding wireless licences and of the consequent increase in revenue, he would give favourable consideration to a reduction in the charge for such licences.

Major Tryon said that this was a matter which must depend on the decisions to be taken on the recommendations of the Broadcasting Committee.

The Broadcasting Committee

In reply to Mr. Hall Caine, the Postmaster-General said that the recommendations of the Ullswater Committee on Broadcasting were still under consideration, and he was not yet in a position to make any statement as to the policy of the Government with regard to them. He would like, however, to take the opportunity of expressing the gratitude of the Government to Lord Ullswater and the members of the Committee for the comprehensive review of the broadcasting service which they had undertaken.

In the Courts

AT Keighley County Court on March 11th Walter Rawnsley, Cullingworth, sued the Bingley Urban District Council for £83 6s. 10d. damages for alleged negligence, or alternatively damages for alleged breach of warranty. Mr. H. Wall (for the plaintiff) said that last September the Council installed a combined plug and switch in the plaintiff's house, which belonged to the Council. The switch was not used until November 6th, when an electric iron was plugged in and tested. It was switched off, but during the night the house caught fire, and damage was done to furniture. Plaintiff said that after the fire the switch was still in the "off" position. The fire was apparently caused by the electric iron, which had burned its way through the floor to the joists.

George L. Bacon, electrical engineer, stated that he examined the switch. Although it apparently went into the "off" position it did not actually operate. Mr. R. Watson (for defendants) contended that it must be proved that the subject matter of the sale was in some definite respect defective and unmerchantable at the time of sale, otherwise trade could not be carried on. The plaintiff had failed to prove that the switch was defective. Bernard Harrison, employed by the makers, said that when he examined the plug he found that there had been a short-circuit, and there was external damage to the switch.

Judge McCleary, giving judgment for the defendants with costs, said that plaintiff had to show that the goods were defective, that they were defective at the time of purchase, and that the damage sustained was caused by a defect in the goods. This he had totally failed to do.

Theft of Electricity

What was described as a widespread practice of "bridging" electricity meters was disclosed at Dunfermline Sheriff Court on March 12th. Three householders pleaded guilty to a charge of fraudulently stealing electricity in their houses between January and March of this year by connecting a wire between the fuse and the terminal board of the electricity meter. An agent for the accused said the offence was more thoughtlessness than one of deliberate fraud. The electric meters involved were of the sixpence-in-the-slot type, and the tenants had discovered that if they did not possess a sixpence it was an easy matter to bridge the meter with a wire and get their electricity for nothing. The houses were all on a £2 minimum rate, and this had to be paid whether the tenants used the electricity or not. The practice, he continued, was becoming somewhat widespread, and although it was a serious matter he thought the publicity given by this case would result in its cessation.

The Prosecutor said that this was the third prosecution of the kind from this particular village. The tenants of the houses thought nothing of burning light night and day. Sheriff Umpherston, remarking that the thing was essentially and obviously dishonest, imposed on each of the accused a fine of 30s.

Winding-up Order

In the Companies' Court on March 16th Mr. Justice Crossman had before him a petition for the compulsory winding up of the Westminster Wholesale Electrical Co., Ltd., presented by the General Electric Co., Ltd.

Counsel stated that the petition was unopposed and he asked for the usual compulsory order. His Lordship directed the winding-up as asked.

Floating Telegraph Repeater Stations

The chief electrical interest of the "seadromes," or floating landing stages for aircraft in mid-ocean, suggested by Mr. F. G. Creed is the possibility of their use as repeater stations for submarine telegraph cables. By the insertion of an automatic repeater mid-way in its length the speed of a cable could be multiplied by four. With five such stations the speed would be increased more than twenty times. Each cable so treated would, it is claimed, provide twenty instead of one duplex teleprinter channels. It is also claimed that the laying of Transatlantic telephone cables would become practicable as the capital expenditure per speech channel would be reduced to less than half. The floating platform would also be equipped with radio apparatus for guiding aircraft and giving essential information to pilots regarding meteorological conditions.

Business and Industrial Notes

The Week's News. Showrooms and Exhibitions. New Installations. Overseas Trade. Publicity Material. Trade Announcements. Prices of Materials. Liquidations and Bankruptcies.

Registered Electrical Contractors

At the last meeting of the Executive Committee of the National Register of Electrical Installation Contractors, the following applications for registration were accepted:—

J. Holmes & Co., Hulme, Manchester 15.
Thos. H. Welsby, Manchester 16.
Morris Bros., Camberley.
Robert D. Batty, Easingwold, Yorks.
Holland & Pendlebury, Bolton.
F. Beardmore & Co., Ltd., Salford 3.
A. E. Stebbing, Westcliff-on-Sea.
Ray Electric, Ltd., Lancaster.
E. G. Kellond, Ltd., 3, New College Parade, Finchley Road, London, N.W.3.
T. Dryden & Sons, Ltd., Preston.

At the same meeting one application was withdrawn and six were declined.

A Heenan & Froude Development

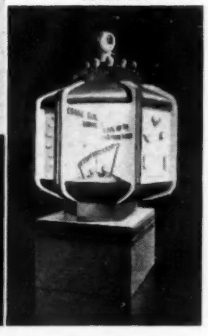
It is announced that a group has acquired from S. T. D. Motors Ltd., the entire assets of Messrs. Heenan & Froude, Ltd., at Worcester, and that the new board will consist of Mr. C. L. Hill, partner, Charles Hill & Sons, Bristol, and chairman of the Bristol City Line of Steamships, Ltd.; Mr. A. P. Good, partner, Pennington & Son, London; Mr. A. W. P. Macwhinnie, director, Dawnay Day & Co., London; Mr. D. H. M. Boyle, director, Andrews Toledo, Ltd., Sheffield; and Mr. W. M. Ratcliffe (present director and general manager who will continue in the same capacity). It is intended that the business shall be carried on as before at Worcester under the same name, but it will be further developed and extended.

Brighter Homes Exhibition, Manchester

A considerable quantity of electrical apparatus is on view in the Manchester Brighter Homes Exhibition now being held in the City Hall, Deansgate, Manchester. Electric refrigerators and cleaners are exceptionally well represented. The principal electrical exhibitors are: Thor Electrical Appliances; Zeros (Sales), Ltd.; Hoover, Ltd.; Beatty Bros., Ltd.; British Vacuum Cleaner & Engineering Co., Ltd.; Ideal Home Electrical Appliances, Ltd.; Henry Hollingdrake & Sons; and W. T. Driver.

Electricity at The Ideal Home Exhibition

Visitors to the "City of Beautiful Night," as the organisers have named the lighting section of this year's Ideal Home Exhibition which is being held at Olympia, London, from March 24th to April 18th, will not fail to be impressed by the wedge-shaped Electrical Section arranged by the British Electrical Development Association. On each side of the entrance will be the stands of the Electric Lamp Manufacturers' Association, which, besides displaying representative products of manufacturers, will make a special feature of a light-sight tester. The various types of lighting equipment will be demonstrated in a practical manner by providing push-buttons and switches which the public can operate itself, while "Miss Elma" will depict on a blackboard by means of a continuous series of humorous cartoons the value of good lighting in the home. From this stand a "tunnel of light" with every type of domestic appliance on each side leads to the forecourt of the E.D.A. exhibit, where a marionette playlet lasting from four to six minutes will point out in a simple yet forceful manner the advantages and economies of electricity in the home. In addition, there will be working demonstrations of electric



"Miss Elma" stresses the value of good lighting and (right) the coiled-coil lamp demonstration

water heating and electric cooking, together with a typical all-electric kitchen suitable for a small dwelling. Two information offices also included in the E.D.A. stand will supply visitors with information regarding the cost, &c., of electrical methods. Among those who have co-operated with the E.D,A, in forming the Electrical Section and also those who have stands elsewhere in the exhibition are the following:—

A. J. Balcombe, Ltd.
Beatty Bros., Ltd.
Belling & Co., Ltd.
Berry's Electric, Ltd.
Bratt Colbran & Co., Ltd.
British Electric Domestic Appliances, Ltd.
British Rototherm Co., Ltd.
British Thomson-Houston Co., Ltd.
British Vacuum Cleaner & Engineering Co., Ltd.
Bulpitt & Sons, Ltd.
Coldair, Ltd.
Corfield-Sigg, Ltd.
Dernier & Hamlyn, Ltd.
W. T. Driver.
Edison Swan Elec. Co., Ltd.
Electrolux, Ltd.
Falk, Stadelmann & Co., Ltd.
Frigidaire, Ltd.
General Electric Co., Ltd.
S. Guiterman & Co., Ltd.
H.M.V. Household Appliances, Ltd.
Hoover, Ltd.
Hotpoint Electric Appliance Co., Ltd.
Hurley Machine Co. (Eng.), Ltd.
Ideal Home Elecl. Appliances, Ltd.
International Refrigerator Co., Ltd.
Kelvinator, Ltd.
Lightfoot Refrigeration Co., Ltd.
New Welbeck, Ltd.
Pressed Steel Co. of Gt. Britain, Ltd.
Searsint, Ltd.
Servis Electric Washers.
Tellus Super Vacuum Cleaner Co., Ltd.
Bertram Thomas.
Vac-Tric, Ltd.

Boiler Drums for Australia

The accompanying illustration shows a consignment of hollow forged steel boiler drums leaving the Vickers works of the English Steel Corporation, Ltd., Sheffield. These vary

Boiler drums at the Vickers works of the English Steel Corporation

from 22 ft. to 26 ft. in length and from 16 to 20 tons in weight, and have been manufactured to the order of International Combustion, Ltd., for East Perth power station, Western Australia.

Electrical Conduit in South Africa

For about two months there has been a deadlock in the importation into South Africa of various forms of metal piping. This has arisen through the imposition, on November 15th last, of a "dumping" duty on all black iron and steel tubes of all sizes up to and including 6½ in. outside diameter, and an extra duty on piping accessories such as bends, elbows and conduit boxes. Since that date importers of such piping and accessories have been paying deposits on all their importations equal to the difference between their "domestic value" and the "export price." Importers of electrical conduit, while agreeing that local industries should be fostered, contend that these dumping duties are preposterous, as only solid-drawn black enamelled conduit pipes can be produced in South Africa. One importer asserts that there are hundreds of conduit accessories that are never likely to be manufactured in the Union. It is also stated that if the present state of affairs continues it will be almost impossible to obtain conduit in Johannesburg and that the numerous buildings now nearing completion cannot be finished.

Recent Contracts

Messrs. Clarke, Chapman & Co., Ltd., of Gateshead-on-Tyne, have received a contract for two high pressure water tube boilers, complete with stokers, superheaters, economisers, air heaters, mechanical draught plant, grit collecting equipment, feed pumps, coal and ash handling plant and buildings for the Portsmouth Corporation power station. The boilers are of the company's cross drum heater type and are each to be capable of evaporating 150,000 lb. of water an hour. The steam pressure will be 625 lb. per sq. in., and will be superheated to a final temperature of 850 deg. F. One of the most interesting features of this equipment is the electrical travelling

crane for the coal handling plant. This crane will be capable of handling 150 tons of coal per hour and will be mounted on a gantry 100 ft. long and 10 ft. high. All the electrical equipment will be supplied by the company, which will manufacture the motors in its shops. The total value of the contract is over £150,000.

The company has also received a contract for boiler plant for Hull Corporation's power station. There will be two tri-drum water tube boilers each evaporating 187,500 lb. of water per hour. The working pressure is 400 lb. per sq. in. and the steam is superheated to a final temperature of 825 deg. F. The value of the contract is about £130,000.

Among the orders received by Messrs. J. Browett Lindley (1931), Ltd., are one for a 1,000-cu. ft. per minute, two-stage, motor-driven air compressor and two 500-cu. ft. per minute, two-stage, steam-driven air compressors for mines in Western Australia. Another motor-driven compressor is under construction for a mine in the Fiji Islands and a 300-kW steam engine driven generating set is being built for a South African mine. In addition, air compressors are being supplied to a North of England steel works and a power station in the south.

The canteen (top) and the all-electric kitchen at Hirst Hall, Wembley

British Plastics Year Book

The 1936 edition of the "British Plastics Year Book" (Plastics Press, Ltd., 15s. net) includes the practical measurement of the hardening velocity of resins and an American method of plasticity testing which have lately received considerable attention. Plastics in packaging and the importance of design in the plastic industry are also reviewed. The same arrangement of sections has been retained, but for easier reference some of the sections have been double-columned.

Social Events

About two hundred persons were present at the annual staff dinner and dance of the Telegraph Construction & Maintenance Co., Ltd., and Submarine Cables, Ltd., which was held at the Connaught Rooms, London, W.C.2, last Friday, Mr. L. J. Ransom taking the chair. In proposing the toast of the company Mr. E. L. Watts referred to the recent formation of Submarine Cables, Ltd., and said that the company was again on a profit-earning basis. In response, Mr. Colin F. Campbell declared that the reason for the returned prosperity was the company's reputation for first-class work. Sir Geoffrey Clarke, replying to the toast of "Submarine Cables, Ltd.," said that the new company had started well, and he believed that submarine cables were going to continue, perhaps with new vigour. Other speakers were Lady Clarke, Mr. B. H. Musgrave, Mr. L. M. Rowe, Mr. A. E. Foster, Mr. R. F. Harvey, and Dr. E. W. Smith.

A new facet to the many-sided social activities of the General Electric Co., Ltd., was revealed to us on March 12th when we visited an exhibition of work by members of the Model Engineering, Arts and Crafts Club held at Magnet House, Kingsway. The exhibition was divided into four sections covering model engineering, crafts, arts, and special items lent, including models by previous prizewinners. The exhibits in all sections were of a high order, those in the model engineering section, which included railway equipment, aircraft and marine models, being beautifully constructed. We were particularly impressed by the exhibits in the arts section which included pen and pencil drawings and oil and water-colour paintings. The chief trophy for the best exhibit is a cup presented by Lord Hirst. During the exhibition a continuous programme of films was given.

The Birmingham Electric Club has arranged to hold spring (April) and summer golf meetings this year. There will be three cups for competition, one for each meeting, and a third for the combined net score at both meetings, in addition to other prizes.

The annual dinner and dance of the London and Home Counties Joint Electricity Authority was held on March 13th at Thames House, Millbank, S.W. Following the loyal toast, Sir John Brooke proposed the toast of "The Association," and referred to the excellent work of Mr. J. Chuter Ede, M.P., chairman of the J.E.A. The Authority had built up a great and prosperous distribution area, the success of which was largely due to the secretary and staff. He had received glowing accounts from electricity consumers in the area. Mr. Chuter Ede, who is president of the Association, in responding, expressed his thanks to those who were responsible for its activities, especially the working officers and committee, and wished it continued success during the coming year. He said that the members' daily contact with consumers enabled them to help in the electrical expansion of the area. He hoped that the McGowan Committee would find opportunity for extending the activities of the Authority. Mr. L. Gordon, chairman of the Association, proposed the toast of "The Guests," to which Mr. W. F. Marchant, past-chairman of the Authority, responded. Mrs. L. M. Ede presented the sports trophies, the cup for all sports, given by Mr. F. W. Purse, being won by Twickenham, and the Gordon Trophy for the tug-of-war by Leatherhead.

Hirst Hall

Considerable extensions during the past twelve months have been made to G.E.C. establishments at North Wembley, and the completion of new buildings has resulted in the engagement of large numbers of additional employés, the total number on the G.E.C. Wembley Estate now being about 2,500. The only canteen accommodation at Wembley hitherto available was originally built for the Union Works, and this has now been superseded by a new building, named Hirst Hall, after Lord Hirst, who, as we reported last week, inaugurated it on March 5th. The new building has been designed, furnished, and equipped to provide the employés with a high standard of comfort, convenience, and service. It is divided into three main sections, which are parallel to one another, the centre section being the kitchen, the main hall, or canteen, and a restaurant being on either side. The canteen is 160ft. long and 50ft. wide, and can accommodate upwards of 1,000 people. The restaurant on the other side of the kitchen seats 200 people, and at one end of it has been built a spacious reception room for visitors. The all-electric kitchen is 150ft. in length and is most up to date. The layout and disposition of the various units make for convenience of working and expeditious service, and at mid-day hundreds are served with a hot dinner within the space of ten minutes, through hatches direct from the series of hotcupboards which run nearly the whole length of one side of the kitchen. All the electrical cooking equipment is of standard type, manufactured at the company's Magnet Works, Birmingham, and includes two cabinet roasting ovens (each taking 300 lb. of meat at one charge), one double-oven range, two boiling tables, and one single-deck baking oven. There are also stockpots, vegetable boilers, steaming ovens, a fish fryer, hotcupboards, a toaster, a griller on stand, while the auxiliary units include an electric washing-up machine, a mixer, a potato peeler, a slicing machine, and a refrigerator. The hot-water equipment is also on the grand scale. The hall has its own sub-station, and the total cooking load is 250 kW.

Safety First Conference

The National Industrial Safety Conference, organised by the National "Safety First" Association, will be held at Balliol College, Oxford, on April 3rd. The opening address will be given by Mr. D. R. Wilson, Chief Inspector of Factories, who will speak on "Accidents and the Young Worker," while other speakers will include Mr. J. V. Peacock, of the London Brick Company and Forders, whose subject will be "Electrical Hazards in Industry."

The Southampton Docks

The Southampton Docks Handbook for 1936, which has just been issued by the Southern Railway, is in similar form to previous editions, and contains detailed particulars of the accommodation and equipment, including a list of electric cranes, trucks and tractors. There is also a good deal of useful

information relating to rates and charges, and regulations and conditions upon which services and accommodation are provided.

A Booklet for Consumers

We have received from West of England Investments, Ltd., a booklet dealing with the hire of electrical appliances which has been prepared for and is being issued by the group of electricity supply undertakings under its control. This sets out in an attractive manner the advantages of electric cooking, water heating, wash boilers, washing machines and refrigerators.

A Clock Display Stand

Smith's English Clocks, Ltd., is offering a display stand free to stockists who order the six electric clocks which it is designed to hold.

Hackney Municipal Showrooms

The extended and altered showrooms of the Hackney Corporation Electricity Department at Lower Clapton Road will be officially opened by the Mayor (Ald. H. E. Goodrich) on Saturday, March 28th. For a period of a month from Monday, March 30th, an exhibition of electrical applances will be held at the showrooms, and demonstrations are being arranged.

Trade Announcements

Messrs. Bruce Peebles & Co., Ltd., Edinburgh, have taken more central offices at 2, Exchange Street, Manchester, 2 (telephone: Blackfriars 1355). Mr. H. V. Balm is in charge.

Messrs. Honor Bros., 71, The Grove, Ealing, W.5, have reorganised their office and ask manufacturers' and suppliers' catalogues of electrical goods and accessories.

The Morecambe Electrical Equipment Co., Ltd., has removed to new premises at Westgate, Morecambe.

The Middlesex Electrical Co., Ltd., 62, Oxford Street, W., asks for catalogues and trade lists from manufacturers of accessories, wiring materials and plant items.

Messrs. W. E. Beardsall & Co., Ltd., are removing on March 23rd to commodious warehouse and showroom premises at 20, Mount Street, Manchester.

Messrs. Arnolds (London), Ltd., electrical engineers and building contractors, are opening new showrooms at 149, Haverstock Hill, N.W.3, early in April and ask for manufacturers' catalogues.

German Electrical Imports and Exports

According to *E.T.Z.* the exports of electrical machinery and cognate material from Germany in 1935, converting Reichsmarks at 12.25 to the £, attained a value of £19,038,368 as compared with £18,476,489 in 1934. On the other hand, there was a decline during the same period in the imports of foreign electrical machinery and materials into Germany—from £2,260,326 to £1,689,470.

A Sunderland Cooker Campaign

Sunderland Corporation Electricity Department last week carried out a successful campaign in conjunction with the General Electric Co., Ltd., for popularising electric cookers in the town. Demonstrations were held twice daily in the Victoria Hall and a large number of consumers signed up for the hire of cookers.

An Electrical Exhibition at Erith

An electrical exhibition is to be held by the Erith Urban District Council at the Exhibition Hall, Walnut Tree Road, from March 23rd to April 4th. Electric cooking and refrigeration will be demonstrated daily.

Empire Exhibition in Johannesburg

The Earl of Clarendon, Governor-General of the Union of South Africa, has consented to open the Empire Exhibition at Johannesburg on September 15th to celebrate the fiftieth anniversary of the city.—*Reuter* (Johannesburg).

For Sale

Messrs. Goddard & Smith will sell by auction at 70, Seymour Place, W.1, on March 26th a stock of electrical material.

Coventry Electricity Department has a quantity of meters for sale.

(See our classified advertisements.)

Electricity Tariffs in London Area

Statement (No. 10) of published tariffs for the supply of electricity, hire of meters, &c., in force in the London and Home Counties Electricity District as at January 1st, 1936, can now be obtained from the Joint Electricity Authority (1s.). The statement will be reprinted in the Authority's statistical publication to be issued later. From to-morrow (Saturday) the address of the Authority will be 5-6, Lancaster Place, Strand, W.C. (telephone: Temple Bar 6644).

An M.C.L. Novelty

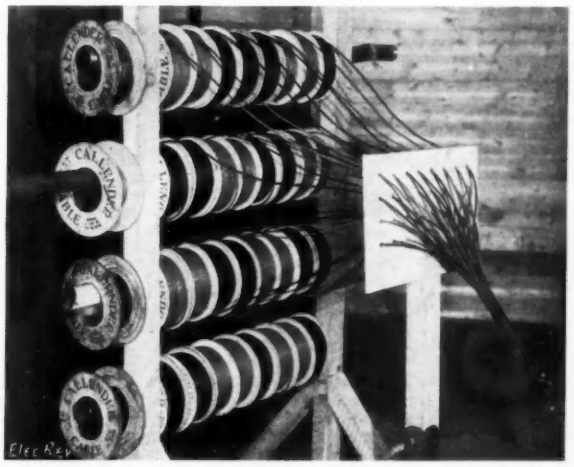
An amusing yet useful miniature "encyclopædia" of its manufactures has been issued by M.C.L. & Repetition Co., which is also supplying a puzzle roller and dice in brass. A small card explains how, having extracted the dice from its casing, a special game can be played utilising the letters engraved on the dice.

The Institute of Export

The Institute of Export has issued a report showing its progress since its inception in January last. The corporate membership already numbered about 250, and a number of men connected with electrical concerns are included in the list of recently elected members issued with the report.

An Unusual Wiring Job

Recently when wiring the remote control of the new magnetic dimmers installed in conjunction with the cinema projectors in the Blackpool Winter Garden Pavilion it was found necessary to draw in simultaneously thirty-two v.i.r. cables into one 2-in. conduit. Although carried out in the normal course of installation work, this operation is believed to be unique on account of the number of cables handled at one



Wiring for the remote control of the new magnetic dimmers at Blackpool Winter Garden Pavilion

time. The length of tubing was 120 ft., with two right-angle bends, and the cables were pulled in by one electrician without the slightest hitch of any kind, the only preparation being the provision of a wooden former bored with sufficient holes for each individual cable to pass through. Since this operation was carried out a further eight similar cables have had to be drawn into the same conduit. The whole of the cable used was of Callender's manufacture, each wire being single conductor 3/.029-in. C.M.A. 600-megohm grade.

Prices of Materials

Messrs. Henry Gardner & Co., Ltd., report, March 18th: No change in the price of copper bars (best selected), sheet and rod. English pig lead, £19, 5s. increase. Spelter, £15 18s. 9d., 3s. 9d. decrease. English block tin, £215 15s., £1 5s. increase.

Messrs. Edward Till & Co. report, March 18th: India rubber, Para fine, 8½d., ¼d. increase.

Messrs. Frederick Smith & Co. report, March 18th: Electrolytic copper bars, £40 10s., 10s. decrease. Ditto, ditto, wire rods, £46 10s., 10s. decrease. Ditto, ditto, h.c. wire, 7¼d., 1/16d. decrease. Silicium bronze wire, 8 5/16d., 1/16d. decrease.

Economic Conditions in Rhodesia

A report (dated October, 1935) on economic conditions in Southern and Northern Rhodesia and Nyasaland, prepared by Mr. J. W. Brigden, H.M. Trade Commissioner at Johannesburg, for the Department of Overseas Trade, has been published by H.M. Stationery Office (1s. 3d. net). Dealing with the imports of Southern Rhodesia, Mr. Brigden states that as regards metals, metal manufactures, machinery, vehicles and electrical machinery, the United Kingdom retained her large proportion of the market. This country also retained practically a monopoly of the market in electric cables and wire, but in other electrical material, Canada, the United States, Germany and the Union of South Africa all claimed a portion. The United Kingdom still held the major position, but did not increase her share to the same extent as the other countries mentioned. In Northern Rhodesia of the total imports of merchandise during 1934 the British Empire supplied 75.8 per cent., against 76.8 per cent. in 1933. Of this the United Kingdom supplied 39.5 per cent., against 33.5 per cent. Imports of electrical machinery showed an increase from £48,302 in 1933 to £179,081 in 1934, the share of the United Kingdom increasing from £32,120 to £139,707. The position of the United Kingdom under the heading "telegraph and telephone instruments, apparatus, and wireless" is not so good. Whilst in 1933 the total imports of wireless apparatus were valued at £4,887 (United Kingdom £2,658 and the U.S.A. £1,996), in 1934, of imports valued at £13,308, the United Kingdom's share increased by only £102, whereas the share of the United States rose by about £8,000. Imports of electrical goods into Nyasaland showed an increase in 1924, the United Kingdom supplying practically the entire demand, the only competition of any importance coming from the United States. In machinery, electrical and industrial, the figures for 1934 showed a slight advance over those for 1933, but no competitor appeared to contest in any serious degree the practical monopoly of the United Kingdom.

New Catalogues and Lists

Provincial Incandescent Fittings Co., Ltd., Shudehill, Manchester.—A complete catalogue of "Pifco" appliances for domestic purposes.

Asea Electric, Ltd., 5, Chancery Lane, London, W.C.2.—A 24-page catalogue covering the "Asea" wiring system designed for severe conditions.

J. A. Brook, Ltd., Lord Street, Huddersfield.—A leaflet describing the "Lox-all," "Complete" and "Klip" lamp locks.

Smith Meters, Ltd., Rowan Road, Streatham Vale, London, S.W.16.—An illustrated spare parts list for the "A.P." prepayment meter.

Switchgear & Equipment, Ltd., Delavox Works, Banbury.—"Extensible" ring main equipment is the subject of a new pamphlet.

"P. and B." Engineering Co., Ltd., Tamworth Lane Works, Mitcham.—Two new leaflets showing the variety of patterns in which the maximum load indicator is now available, and giving particulars of the maximum demand alarm.

Star Electro Carbons, Cleveland Road, London, E.18.—A complete catalogue of various types of brushgear.

Blackall Bros. & Berrys, Ltd., Stratford Market, London.—A booklet on electrical insulating compounds.

Stanwell Quality Tools, Ltd., 119, The Chase, London, S.W.4.—A catalogue of "Stanqualit" engineers' tools.

Victor X-Ray Corporation, Ltd., 15-19, Cavendish Place, London, W.1.—A catalogue illustrating and describing the Victor model "D" series of oil-immersed mobile X-ray diagnostic units.

A. Reyrolle & Co., Ltd., Hebburn-on-Tyne.—An improved range of domestic water heaters is dealt with in leaflet No. 997.

Wenham Lighting Corpn., 3 and 4, Henry Street, Gray's Inn Road, London, W.C.1.—A new all-insulated hand inspection lamp is described in a new leaflet.

Bankruptcy Proceedings

J. W. Roberts, 19, Twiss Green Lane, Culcheth, electrician.—The public examination herein was held on March 10th at the Court House, Mawdsley Street, Bolton. According to the statement of affairs there was a deficiency of £564. Debtor said he had been associated with two others in a partnership business carried on at Silk Street, Leigh. He himself had had little to do with the business, and his present position was due entirely to the purchase and retention of cotton mill shares in respect of which he had paid £3,960. At the present time the shares were practically worthless. The examination was closed subject to the signing of the notes.

R. Field, 61, Drewton Street and 156, Westgate, Bradford, electrical engineer.—The first meeting of creditors was held at the Official Receiver's office, Hallfield Chambers, 71, Manningham Lane, Bradford, on March 11th, when it was disclosed that there was a deficiency of £303. The case being a summary one was left in the hands of the Official Receiver as trustee.

F. T. Wood (Wood & Jackson), electrical contractor, Boundary Works, Wragley Road, Lincoln.—Receiving order made March 5th on debtor's own petition. First meeting March 20th at 1, St. Swithin's Square, Lincoln. Public examination, March 26th, at the Sessions House, Lincoln.

L. Holzman, manufacturer of wireless equipment, 1, Robert Street, Hampstead Road, London.—Discharge suspended for two months until April 13th.

I. Faulkner (Provincial Lighting & Engineering Co.), electrical engineer, 369, Eccles New Road, Weaste, Salford.—Discharged as from March 11th, 1935.

W. A. Hammond, wireless dealer, Middle Street South, Great Driffield.—First and final dividend of 2⅝d. in the £, payable March 17th, at 1, Parliament Street, Hull.

H. E. Haynes, electrical and accumulator dealer, 16, Frensham Road, New Eltham, Kent.—Receiving order made March 10th on a creditor's petition. First meeting March 24th and public examination April 30th, both at Carey Street, W.C.

H. L. Ruff, electrical engineer, 141, Abbeydale Road, Sheffield.—Receiving order made March 9th on debtor's own petition.

F. E. Lansdown, radio and electrical engineer, 68a, High Street, Winsford.—Last day for receiving proofs for dividend March 30th. Trustee, Mr. F. C. Ormrod, 12, Lonsdale Street, Stoke-on-Trent, Official Receiver.

A. Hunt, wireless dealer, 2a, Eldon Street North, Barnsley.—First and final dividend of 1s. 3½d. in the £, payable March 13th at 13, Burton Street, Wakefield.

G. A. Glazebrook (Coventry Electrical & Wireless Supplies), 27a, Victoria Street, Coventry.—Supplemental dividend of 6½d. in the £, payable March 21st at 9-11, High Street, Coventry.

Company Liquidations

Britannic Electric Cable & Construction Co., Ltd.—Winding up voluntarily. Liquidator, Mr. S. R. Hogg, River Plate House, Finsbury Circus, E.C.2.

Kirkby Stephen Electric Light & Power Co., Ltd.—Winding up voluntarily. Liquidator, Mr. R. R. Sowerby, Winton House, Winton, Kirkby Stephen, Westmorland.

Llanrwst Electricity Supply Co., Ltd.—Meeting April 22nd at 24, Coleman Street, E.C.2, to receive an account of the winding-up by the liquidator, Mr. J. C. Gardner.

John Short, Ltd.—Winding up voluntarily. Liquidator, Mr. H. P. Gowen, 7, Queen Street, Norwich.

Private Arrangement

T. B. Smith, wireless dealer, 131, Hockley Hill, Birmingham.—The creditors met recently at the offices of Messrs. Poppleton & Appleby, Midland Chambers, Warwick Passage, Corporation Street, Birmingham. The statement of affairs showed ranking liabilities of £1,068 and net assets of £151, or a deficiency of £916. The debtor's solicitor intimated that it might be possible to submit an offer of 7s. 6d. in the £. The creditors decided to allow the debtor time within which to submit such an offer.

Belgian Foreign Electrical Trade

THE following table, based on the recently issued foreign trade returns, shows the values of Belgian electrical imports and exports last year as compared with 1934, in thousands of Belgian francs (125 to the £). Imports of electrical machinery and apparatus as a whole increased during the year by 35,700,000 fr., while exports of such goods increased by 59,400,000 fr., all the main groups of the latter showing advances (notably telephone apparatus), except dynamo-electric machines. On balance, Belgium is still an importer of electrical material, her total purchases from abroad last year being valued at a total of 319,300,000 fr. and her exports at 225,400,000 fr.

IMPORTS.	1935. Fr. (000).	Inc. or dec. compared with 1934 Fr. (000).
Dynamo electric machines—		
Total	51,600	+ 10,300
From Germany	26,900	+ 6,100
„ France	6,100	+ 100
„ Sweden	5,200	+ 1,100
„ Switzerland	4,700	+ 1,100
Dry batteries—		
Total	4,900	+ 100
From Germany	1,300	+ 100
„ Denmark	2,300	—
Accumulators and plates—		
Total	2,200	— 600
From United Kingdom	600	— 100
„ Germany	600	—
„ United States	600	— 300
Cables, submarine and underground—		
Total	1,500	+ 1,100
From Germany	500	+ 300
„ France	500	+ 300
Other insulated wire and cable—		
Total	13,750	+ 5,060
From Germany	5,900	+ 1,600
„ United Kingdom	600	+ 400
„ Switzerland	4,100	+ 2,100
„ Holland	1,200	+ 630
Metal filament lamps, gas-filled—		
Total	6,500	— 100
From Hungary	2,000	+ 400
„ Holland	3,100	+ 500
Ditto, vacuum—		
Total	11,700	+ 1,800
From Germany	3,300	—
„ Japan	2,100	+ 1,600
„ Holland	4,500	+ 700
Wireless sets—		
Total	17,900	— 21,100
From Germany	5,800	— 500
„ United States	1,700	— 2,300
„ Holland	7,900	— 14,800
„ United Kingdom	1,400	— 2,400
Loudspeakers, transmitters, condensers, transformers and pick-ups for radio—		
Total	6,800	+ 400
From Holland	3,300	+ 1,300
„ United States	1,400	— 700
Radio parts, unspecified—		
Total	19,000	+ 7,000
From Germany	3,100	—
„ United States	4,500	+ 1,700
„ Holland	6,400	+ 3,000
Wireless valves—		
Total	33,700	+ 4,700
From Holland	12,900	+ 1,300
„ United States	12,800	+ 4,800
Measuring instruments and parts—		
Total	10,600	— 2,700
From Germany	2,600	— 1,000
„ Switzerland	6,400	— 2,000
Carbons—		
Total	4,800	+ 300
From Germany	2,500	+ 700
„ United States	800	— 600
Insulators—		
Total	1,800	— 600
From Germany	800	+ 100
„ France	800	— 400
Bulbs for metal-filament lamps—		
Total	7,700	+ 1,600
From Germany	2,800	+ 200
„ Holland	2,700	+ 200
Insulating tubes and junction boxes—		
Total	5,500	+ 1,700
From Germany	4,100	+ 1,000
Insulating material, unspecified—		
Total	3,600	+ 300
From Germany	1,600	+ 400
Telegraph and telephone apparatus—		
Total	3,800	+ 1,300
From Germany	2,300	+ 1,000
Electrical apparatus not elsewhere specified—		
Total	124,000	+ 22,000
From Germany	53,000	+ 11,000
„ France	17,500	+ 500
„ Holland	15,000	+ 5,200
„ United Kingdom	9,600	+ 3,100

EXPORTS.	1935. Fr. (000).	Inc. or dec. compared with 1934 Fr. (000).
Dynamo-electric machines—		
Total	20,000	— 4,700
To Congo	1,200	— 1,000
„ Holland	3,500	+ 1,400
„ China	700	— 1,400
„ Argentina	1,600	— 2,100
„ Brazil	2,000	+ 1,200
„ Egypt	2,300	— 700
Accumulators and plates—		
Total	2,500	+ 300
To Holland	600	+ 300
Submarine and underground cables—		
Total	27,000	+ 7,000
To United Kingdom	5,200	— 400
„ Holland	1,800	+ 500
„ Germany	9,300	+ 1,900
„ Egypt	2,300	+ 700
Other insulated wire and cable—		
Total	20,600	+ 4,200
To Morocco	1,300	+ 700
„ Holland	1,300	+ 400
„ United Kingdom	6,800	+ 800
„ Egypt	1,400	+ 1,000
Metal-filament lamps—		
Total	13,100	+ 2,100
To Holland	400	— 100
„ India	1,800	+ 1,000
„ Argentina	3,800	+ 1,400
Telegraph and telephone apparatus—		
Total	75,000	+ 31,000
To Argentina	6,600	+ 5,500
„ Switzerland	5,000	+ 3,000
„ Brazil	21,000	+ 12,000
„ Denmark	7,000	+ 5,000
Electrical apparatus not elsewhere specified—		
Total	23,700	+ 4,100
To Holland	2,900	+ 1,900
„ Switzerland	2,500	— 800
„ Czechoslovakia	4,700	+ 1,700
Wireless apparatus and parts—		
Total	19,300	+ 12,100
To France	6,700	+ 4,900
„ Holland	10,200	+ 6,800

Electricity Supply

Lighting, Domestic, Power

Alnwick.—DISAGREEMENT OVER REMOVAL OF GAS FITTINGS.—The terms of the North-Eastern Electric Supply Co., Ltd., for the installation of electricity in Council houses have been rejected by the U.D.C. The Council takes exception to a clause relating to the removal of gas fittings and the placing of the electrical fittings in the positions which gas ones now occupy in the living rooms.

Australia.—WATER POWER FROM THE BARRON RIVER.—The hydro-electric plant on the Barron River, Queensland, has now been completed and put into service, states the *Electrical and Radio Trader of Australasia*. The original site of the power house in the Barron gorge had to be abandoned owing to the danger of landslides. Instead, an excavation was made in the gorge wall and the plant placed underground. A chamber 90 ft. by 30 ft. by 26 ft. was hewn out of the solid rock, together with 15-ft. pits below floor level for the waste water outlets. Two turbines, developing 2,000 h.p., have been installed, and there is space for a third. The scheme has cost £155,000. The district to be served embraces a vast field of industrial and agricultural activity.

QUEENSLAND COMMISSION.—It is reported that the Queensland Government has appointed a Commission to make a full survey and investigation of the State's electrical resources for the purpose of co-ordinating the future development of electric light and power schemes.

Blackpool.—RECTIFYING EQUIPMENT.—The transport manager has been authorised to consult the electrical engineer with regard to the installation of mercury arc rectifiers for the supply of electricity to the tramways at Harrowside, and tenders are to be obtained for the necessary equipment and cables.

Cardiff.—NEW FEEDER.—A new cable is to laid by the Electricity Committee from the Roath power station to Park Lane, at a cost of £2,200.

CHANGE-OVER.—A further change-over is to be effected by the Electricity Committee at a cost of £7,000.

MAINS EXTENSIONS.—The Electricity Committee is to spend £8,000 on mains extensions.

Carlisle.—ELECTRICAL INSTALLATIONS.—Permission has been obtained by the Electricity Committee to borrow £7,000 for wiring installations.

Colchester.—LOANS SANCTIONED.—The City Council has received sanction to loans of £30,000 for mains and services, £6,000 for sub-stations and equipment, £5,000 for consumers' wiring installations, £9,000 for meters, and £18,000 for consumers' electrical apparatus.

Crewe.—NEW TARIFF.—The Town Council has adopted a factory lighting tariff of 3½d. per kWh for the first 500 kWh per quarter, and 2d. per kWh beyond.

Darlington.—STANDBY SUPPLY FROM C.E.B.—A settlement has been reached between the Town Council and the Central Electricity Board regarding the amount to be paid to the Board for a standby supply of electricity. The matter was settled after being submitted to the Electricity Commissioners for arbitration. The C.E.B. claimed £4,174, while the Council contended that the amount should be £1,505. It was eventually agreed to pay the Board £3,470. A report was submitted by the borough electrical engineer which stated that the Corporation generating station was connected with the grid in June, 1932, and from that date the C.E.B. had been in a position to give a supply should the demand upon the Corporation station exceed its capacity. To date the Corporation had only had to take a few hours' supply owing to a minor derangement in one of the generating sets. The grid, however, was a valuable asset to Darlington and had obviated the necessity of the Town Council increasing its capital expenditure by the provision of standby plant.

Derby.—LOANS.—Application is to be made by the Electricity Committee for sanction to borrow £10,000 for specified sub-stations and equipment, £66,000 for cookers, £12,500 for meters, £45,000 for mains and services, and £24,000 for switchgear and transformers.

Douglas (I.O.M.).—LOANS.—Sanction is being sought by the Electricity Committee to loans of £8,000 for mains, £2,750 for meters, and £2,750 for cookers.

ILLUMINATIONS.—The borough electrical engineer is to prepare a comprehensive scheme of public and decorative lighting for the town.

East Ham.—SUB-STATION.—A sub-station is to be provided by the Electricity Committee in Green Street at a cost of £5,242.

Eston.—LOANS.—The Electricity Committee is to borrow £1,000 for meters and is to seek permission to borrow £4,000 for mains and £900 for equipment.

France.—A LONG E.H.V. TRANSMISSION LINE.—The Société de Transport d'Energie du Centre-Ouest has been authorised to proceed with the erection of a 150,000-V transmission line between Pessae and Cholet, a distance of about 190 miles.

Gravesend.—REFRIGERATOR CAMPAIGN.—A balance of £1,800 on last year's electricity undertaking net revenue account is to be appropriated by the Corporation for the purchase of electric refrigerators to be offered to customers on a hire-purchase system. The refrigerators will be fitted free of cost. It is hoped to increase the consumption of electricity by this means during the summer months, when a reduced charge becomes operative. The advantages of refrigeration will be stressed at an exhibition to be held by the Electricity Department during the week commencing March 30th.

Hastings.—SUB-STATIONS.—In order to increase the voltage in the Battle, Catsfield, Ninfield, Hanleys Down and Netherfield areas the Corporation is to erect a sub-station at Lower Lake, Battle, at an estimated cost of £2,885; additional equipment is also to be installed at the new sub-station at Harold Place (£2,645).

SUPPLY TO PEASMARSH.—At a cost of £1,440, the Electricity Committee is to provide a supply to Peasmarsh by overhead lines.

MAINS EXTENSIONS.—The Electricity Committee is to extend mains to new estates (£1,920).

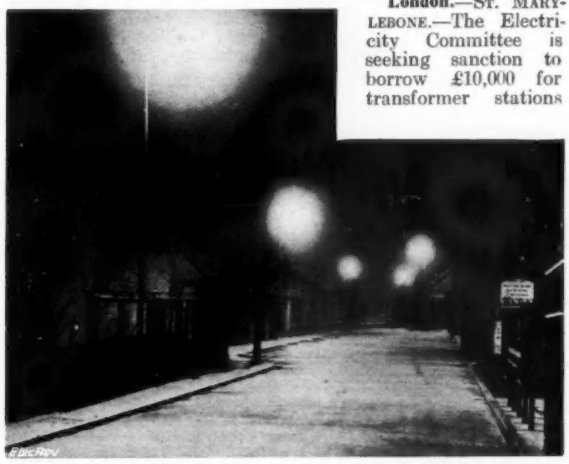
LOANS.—Sanction is being sought to loans of £20,000 for mains and £10,000 for services.

India.—MYSORE'S ELECTRICAL PROGRESS.—The latest report of the Mysore State Electricity Department shows that its chief activities during the past year were directed towards extending the supply of power to smaller towns and villages. Moreover, to popularise the use of electricity for agricultural purposes, the rate of power supplied to irrigation pumps was reduced from one anna to half an anna per kWh, states our Bombay correspondent. The total power generated amounted to 200,754,000 kWh, and there was an increased consumption owing mainly to the additional power taken by the gold mining companies operating in the State and to the supply of power to places newly electrified. New power installations numbering 469 and lighting installations numbering 3,421 were added during the year, making the total numbers 3,142 and 25,184 respectively. A transmission line to Bhadravati, the site of the State iron works, has recently been under construction. Special attention was devoted to the manufacture of transformers of higher capacity. The local production of smaller electrical appliances is being fostered by a committee specially appointed for the purpose.

Lichfield.—EXTENSIONS.—The Electricity Committee is to extend mains and erect a sub-station in Walsall Road, at a cost of £4,216.

Liverpool.—NEW CLARENCE DOCK CHIMNEY.—Application is being made to the Electricity Commissioners by the Clarence Dock Power Station (Special) Committee for permission to borrow £30,109 to cover the cost of a new reinforced concrete chimney, flues and No. 1 downcast chamber.

London.—ST. MARYLEBONE.—The Electricity Committee is seeking sanction to borrow £10,000 for transformer stations on consumers premises; it has also approved a scheme for extensions in the St. John's Wood district.



Notices prohibiting smoking and requiring cars to travel slowly show up clearly in the light of the 400-W "Osira" lamps which have been installed for factory approach and yard lighting by the British Xylonite Co., Ltd., Hale End, London, E.

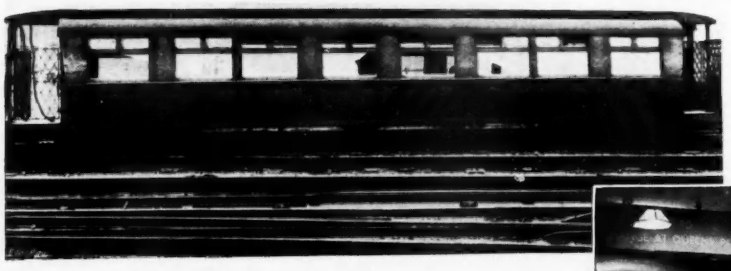
Marple (Cheshire).—The Urban District Council is to supply electricity for domestic water heating at ½d. per kWh.

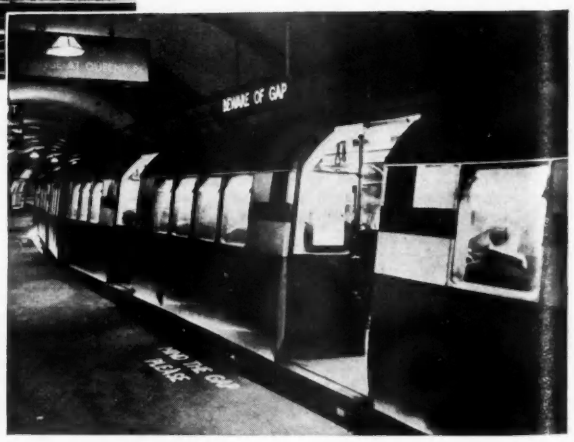
Newcastle-on-Tyne.—PROPOSAL TO PURCHASE UNDERTAKINGS IN THE CITY AREA.—Consideration is being given by the City Transport and Electricity Committee to the purchase of the two electricity distributing undertakings within the city area. It is proposed to take over the system at Benwell and Fenham owned by the Newcastle and District Electric Lighting Co., Ltd., the Council's contract with the Company being terminable at short notice. A special sub-committee is also discussing the question of acquiring the system in Newcastle at present controlled by the North-Eastern Electric Supply Co., Ltd., which the Council has an option to purchase next year. Official estimates state that it would cost about £225,000 to buy the undertaking of the Newcastle and District Co. in the areas concerned, and £2,250,000 for the North-Eastern Electric Supply Co.'s system. It is understood, however, that the actual figures may be higher. The Electricity Commissioners are being approached in the matter.

South Africa.—PRIESKA SCHEME.—The Prieska (Cape) Municipal Council has made arrangements with an insurance company for a loan of £20,000 in order to carry out a combined electricity and water scheme. Tenders have already been accepted for most of the work. The power plant will supply electricity to the town and also pump water from the Orange River.

ELECTRICAL ACTIVITY IN PRETORIA.—The annual report for the year ended June 30th last which we received this week from Mr. L. L. Horrell, city electrical engineer of Pretoria, shows that the rate of electrical development in the capital of the Transvaal has been accelerated. Domestic supplies increased by 16.7 per cent. as compared with an improvement of 7.8 per cent. in 1933-34, and Mr. Horrell looks forward to an even more marked expansion in the current year in view of the introduction of a new domestic tariff and improved facilities for the installation of electrical appliances. The influence of the Department's "Electricity House" in Church Street is reflected by the increasing use of domestic electrical equipment. In the past three years the additional cookers connected to the mains numbered 198, 323 and 550, respectively, while in the case of refrigerators, as far as can be ascertained, the figures were 105, 168 and 600. Altogether, sales amounted to 52,445,819 kWh (17.5 per cent. more than in the previous year), bulk supplies accounting for half of this amount. The improved state of industry is shown by an increase of 19.7 per cent. in power supplies, against 5.8 per cent. in 1933-34. Considerable additions to plant were undertaken during the year, including the installation of a new B.T.H. 12,500-kW turbo-alternator and two 100,000 lb./hr. Yarrow boilers. A third boiler has been ordered and is expected to be installed by March next year. Seven sub-stations were equipped with new 11 kV switchgear and twelve miles of interconnecting feeder was laid.

Switzerland.—ELECTRICITY OUTPUT.—The Swiss Federal Department of Electricity has recently issued a report showing the production of electric power in Switzerland during the twelve months ended September, 1935. The report covers all generating plants in the country with a capacity exceeding 300 kW, representing about 95 per cent. of the total. The output of public supply hydro-electric plants advanced from 4,064 million kWh in 1933-34 to 4,349 million kWh. On the other hand, that of the steam and internal-combustion-engined stations declined from 14 to 10 million kWh. In the case of power imports from neighbouring countries there was an increase from 7 to 13 million kWh. The power plants connected with the Swiss Federal railways were responsible for an output of 1,333 million kWh, as compared with 1,270 million during the previous year. The total production for 1934-35 is given as 5,705 million kWh, an increase of 350 million kWh. During the year 1,236 million kWh was utilised for domestic and agricultural purposes, 689 million kWh for general power and lighting, 778 million kWh by the electro-chemical and metallurgical industries, 343 million kWh for steam raising and water heating in electric boilers, 461 million kWh for traction on the Federal railways, and 172 million kWh on other railways.





The Bakerloo "tube" has just celebrated its thirtieth anniversary: the change in the appearance of the rolling stock is well depicted in these illustrations

Sunderland.—SUPPLY FROM C.E.B.—The Corporation has decided to accept the offer of the Central Electricity Board for a temporary supply of electricity, the Board having intimated that it is averse to sanctioning any extension of plant at the Corporation's generating station. The Board has agreed to the Corporation continuing to run one 10,000 kW turbo-generator.

Swansea.—LOANS.—Sanction is being sought by the Electricity Committee to a loan of £150,000 for mains and services and £15,000 for public lighting.

Swinton and Pendlebury.—DISTRIBUTION EXTENSIONS.—The Corporation has applied for a loan of £49,300 for electrical distribution purposes.

Tasmania.—ELECTRICAL PROGRESS AT LAUNCESTON.—The annual report of the city electrical engineer (Mr. R. J. Strike) for the year ended June 30th last, shows a general improvement in the financial side of the undertaking. There was an increase of £1,528 in the net revenue, bringing the total to £75,229, and working costs, which amounted to £52,952, increased by £614, while the net surplus of £6,599 was £699 more than in the previous year. Due to reductions in charges there was a decrease in the revenue per kWh sold to 1.105d.; the aggregate sales amounted to 15,032,635 kWh.

Torquay.—SUPPLY IMPROVEMENTS.—A sub-station is to be erected by the Electricity Committee and improvements made in the distribution system at St. Marychurch at a cost of £14,150.

ELECTRICITY FOR STOKE.—It is proposed to provide a supply of electricity to Stoke-in-Teignhead. The cost is estimated at £1,700.

Wallasey.—ELECTRICAL DEVELOPMENTS.—A scheme for the provision of a 6,600-V ring feeder main with three sub-stations, &c., at a cost of £31,385, has been approved by the Electricity Committee.

Wales.—STREET LIGHTING.—A number of electric-discharge street lighting installations have recently been put into operation in Wales, notably in the Port Talbot, Aberavon and Bridgend districts. The Port Talbot and Aberavon installations carried out for the Port Talbot Electricity Department, under the supervision of Mr. C. Garfield Richards, consist of 400-W "Osira" lamps housed in G.E.C. "Tunbridge Wells" and "Di-fuser" lanterns. The mounting height is of the order of 25 ft. and the average spacing is 170 ft. The installation carried out for the Bridgend Urban District Council, under the direction of Mr. W. Welbury, electrical engineer and manager, comprises "Osira" lamps and "Di-fuser" lanterns.

Winchester.—TRANSFER OF SUPPLY AREAS.—The Corporation has applied for powers authorising it to transfer parts of King's Worthy and Headbourne Worthy to the Mid-Southern Utility Co., which is already giving certain supplies in these areas under Fringe Orders.

Traction

Australia.—BRISBANE TRAMWAYS.—To meet the rapid traffic expansion on the Brisbane city tramways, machinery for another sub-station has been ordered. Between July 1st and November 20th last the increase in passenger journeys was at the rate of six millions per annum, states the *Electrical and Radio Trader of Australasia*.

Belgium.—BRUSSELS UNDERGROUND RAILWAY.—According to *The Times*, a director and an engineer of the German railways have exhibited in Brussels a film of the work now in progress in Berlin on a new north to south underground railway. A similar railway is to be built in Brussels to provide an underground connection between the Gare du Nord and the Gare du Midi, with an additional central station.

France.—MAIN-LINE ELECTRIFICATION.—The Culoz-Chambery section of the P.L.M. Mont Cenis route to Italy was opened to full electric working recently, after a few months of trials and partial operation. The sub-station equipment was installed in 1930 when the Chambery-Modane line was being converted to 1,500 V d.c. electrification. Electrically hauled trains now run through from Modane to Culoz, 85 miles.

Great Britain.—ELECTRIC LINE TO ENFIELD.—A joint conference between the London & North Eastern Railway authorities and the Hornsey, Wood Green, Southgate and Enfield Borough Councils was held on Tuesday to consider the electrification of the line from King's Cross to Enfield.

THIRTIETH ANNIVERSARY OF A LONDON "TUBE".—The Bakerloo Railway of the London Passenger Transport Board celebrated its thirtieth anniversary of continuous work last week. When operation of the line began 20,000 to 30,000 passengers travelled on week-days. To-day the figure has risen to 170,000 passengers. At first the line was 3¼ miles long, whereas its length is now 21 miles, and when the Board has completed its programme of improvements it will be 32 miles. The Bakerloo Co. was incorporated on March 28th, 1893, and construction began in 1898. In March, 1902, the Underground Electric Railways Co. entered into a contract with the Bakerloo Co. for the completion of the partly built line. The Bakerloo line has been a pioneer in railway practice. The first "passimeter" or island type ticket office was installed at Kilburn Park station. Landing control was first applied to lifts at Great Central (now Marylebone) station in 1913, thus speeding up the lift services. Then came the escalator. The first on the Bakerloo line was installed at Paddington in December, 1913. The only previous escalators in London were at Earl's Court in 1911 and at Liverpool Street in 1912. The Bakerloo was the first line to introduce ticket machines on a large scale. To-day nearly two million tickets a week are taken from machines.

Holland.—Big Conversion Scheme.—The Netherlands Railways have announced their intention of extending the present electrified system between Amsterdam, Rotterdam and Dordrecht to the Amsterdam-Arnhem, Hague-Utrecht, Rotterdam-Gouda, and Utrecht-Eindhoven lines, all of which carry fast main-line traffic. The present 1,500-V d.c. electrification will thereby be extended from 125 to 270 route-miles.

Norway.—Railway Electrification.—The Norwegian Council of State has decided to lay before the Storting a proposal for the electrification of the western line of the Ostfold railway between Ski and Kornsjo. The expenditure is estimated at 12,904,000 kr.

South Africa.—Progress of Rand Railway Electrification.—Good progress is being made with the electrification of the Rand railway system. It is expected that by the spring of next year some 81 route-miles will be opened from Randfontein to Springs. Orders have been placed in England for 72 motor coaches at a cost of £540,000, while 166 coaches are being adapted in the railway workshops.

Switzerland.—High-Speed Trains.—The sum of 1,250,000 Swiss francs has been added to the 1936 budget of the Swiss Federal Railways to cover the cost of two streamlined, lightweight, three-car electric trains for very fast services on certain main lines. These trains will seat about thirty second-class and 130 third-class passengers, and will have a maximum speed of 93 m.p.h.

Tasmania.—Launceston Tramways' Successful Year.—An increase of £1,391 in the net profit, bringing the figure up to £2,973 for the year ended June 30th last, is shown in the annual report of the city electrical engineer, Mr. R. J. Strike. The total revenue was £50,330 (an increase of £463), and working expenses decreased by £1,860 to £35,649. The car mileage was 507,191 and the number of passengers carried 4,361,671.

United States.—Improved Tramcars.—The Baltimore Transit Company has recently ordered twenty-seven tramcars of improved design. According to *Mass Transportation*, the vehicles, which will be of the single-deck type and streamlined, will measure 46 ft. from bumper to bumper and will seat fifty-four passengers. Each will have four spring-mounted G.E. 55-h.p. lightweight (700 lb.) motors and will be capable of a maximum acceleration of 4.75 miles per hour per second. The wheels will be ringed with rubber to absorb vibration.

Communications

Australia.—Two New Broadcasting Stations for Melbourne.—As soon as funds are available the Australian Postal Department proposes to erect two radio broadcasting stations on a site near Melbourne to replace existing transmitters which are out of date and costly to operate. Each will cost £30,000 and will be rated at 10 kW, capable of being increased to 60 kW.

China.—Communication Developments.—Plans for the development of the long-distance telephone system in the province of Fukien have recently been mapped out by the Provincial Government authorities for submission to the Ministry of Communications, according to the *Far Eastern Review*. One of the projected lines is to link Foochow, the provincial capital, with Wenchow, an important port in south-eastern Chekiang. Double lines will be installed on the Nanping-Kienyang-Pucheng and Kienyang-Shao-wu circuits in the north, and the Tingchow-Liencheng-Nantsing-Lungki circuit in the south. The cities of Changpu, Lunki, and Sienyu will also be connected. Elaborate plans for a network of long-distance telephone lines along the main railways in China have been placed before the Ministry of Communications.

Denmark.—Proposed Direct Link with Britain.—For some time past negotiations have been proceeding with a view to a direct telephone cable being laid between Britain and Esbjerg, the cost of which is estimated at 20,000,000 kr. It is stated that the British authorities are prepared to provide one half of the amount if Sweden, Norway, and Denmark will furnish the remainder. It is stated, however, that both Norway and Sweden are opposed, in principle, to the expenditure of money on the establishment of cables between foreign countries.

Conference.—A report from our Copenhagen correspondent states that an international convention of telephone authorities is to be held this summer in Copenhagen. Besides the discussion of international rates for long-distance calls, plans will be dealt with for the extension of long-range telephony, particularly with a view to meeting the growing requirements of broadcasting. The convention will be held under the auspices of the Commission Consultative Internationale; the Danish Postmaster-General, Mr. Mondrup, and the chief engineer of the Danish broadcasting concern, Mr. Kay Christiansen, will act as hosts.

Germany.—Automatic Telephone Exchanges.—According to the *Journal des Télécommunications*, Germany is at present the leading country in the use of automatically operated telephone exchanges, no fewer than 82.6 per cent. of the principal exchanges being of this type.

Great Britain.—Radio Licences.—During February, 776,663 radio licences were issued by the Post Office, making the total number in force at the end of the month 7,573,793, which represents a net increase of 94,960 during the month and 619,505 during the year.

Increased Power of Regional Stations.—It is stated that the power of the West and Midland Regional stations has been raised to 70 kW. The London, North, and Scottish transmitters are shortly to be treated similarly.

New Automatic Exchanges.—The Chancery telephone exchange was converted from manual to automatic working last Saturday. Over 1,200 lines were affected. Work has also been put in hand on a new automatic telephone exchange at Spring Terrace, Richmond. The initial capacity will be 4,500 lines.

Television Progress.—July 1st is the provisional opening date of the B.B.C.'s Alexandra Palace television station. The last stages of construction have been reached and the delicate operation of fixing the 215-ft. mast on the summit of the rebuilt 84-ft. brick tower is about to begin. This mast is to be pinned to the tower without any supporting stays. Though it has been completed separately it will take from three to six weeks to re-erect. The upper part of the mast will be octagonal in shape, and from it will radiate two sets of arms carrying short lengths of vertical aerial wire, from which the sound and vision will be broadcast. The Baird Company has already begun to install machinery in the palace, but neither the Baird nor the Marconi-E.M.I. Company has yet assembled transmitting gear there.—*Daily Telegraph*.

Telephone and Telegraph Progress

THE reports for 1935 which we have received from various district telegraph and telephone engineers all speak of a considerable expansion in traffic and give details of extensive schemes undertaken during the year for improving the services. In the Manchester area, which covers 520 sq. miles and for which Mr. R. G. de Wardt is superintending engineer, the number of telephones installed rose by 5,746 to 111,401; there were similar increases from other parts of the country, for instance in Birmingham (engineer Mr. H. Faulkner) the number increased by 6,755 to 98,485; in Sheffield (Mr. A. Wright) by 2,570 to 34,936; in West Yorkshire (Mr. F. G. C. Baldwin) by 5,734 to 87, 096; in North Wales (Mr. H. Faulkner) by 4,778 to 57,863; in Liverpool (Mr. R. G. de Wardt) by 4,765 to 85,871; in the North Midlands (Mr. A. Wright) by 8,635 to 110,565; and in the North-Eastern District (Mr. F. G. C. Baldwin) by 5,041 to 57,774. The calls made from the various districts during the year, with increases in parentheses, were:—Manchester, 83,750,000 (5,750,000); Birmingham, 86,500,000 (8,415,000); North Midlands, 71,394,732 (6,339,338); Liverpool, 79,000,000 (4,000,000); Newcastle, 36,871,000 (2,463,000); North Wales, 32,520,000 (4,300,000); West Yorkshire, 68,951,751 (3,210,000); Sheffield, 25,190,000 (3,110,000); and North-Eastern District, 36,026,581.

Throughout the country automatic exchanges are replacing those manually operated; last year three of these conversions took place in Birmingham, eleven in the North Midlands, six in Newcastle, and ten in North Wales, including the new exchange at Aberystwyth. There is also a new automatic exchange at Bridgnorth, which comprises seven smaller exchanges. Arrangements are in hand for many more conversions, and considerable extensions are being made in all districts, particularly the North Midlands, to the existing manual boards. In Birmingham 68 per cent. of the service is now automatic, and the new automatic exchange at Stratford-on-Avon was opened during the year. A similar exchange at Heddon, in the Newcastle area, is stated to be the first to be equipped with multi-metering apparatus giving facilities for direct dialling to neighbouring exchanges up to ten miles radial distance. In North Wales there are 393 new exchanges, of which 127 are automatic, and in the North-Eastern District there are 348 (130 automatic).

To cope with the additional traffic many new cables are being laid in all areas, while arrangements are being made to extend the London to Birmingham coaxial cable, which has recently been laid, but is not yet in operation, to Manchester. This type of underground cable is an innovation inasmuch as it is hoped that four pairs of physical conductors will each be capable of carrying 320 circuits. It will also be possible to use the cable for television. Another recent development is the "Autodial," which enables a subscriber to obtain twenty-four or forty-nine specified numbers, according to the size of the instrument that is used, merely by pressing a button.

Equally encouraging are the telegraph reports, the introduction of the sixpenny telegram having resulted in a considerable increase in traffic. In the North Eastern District the increase in telegraphic transactions as compared with 1934 was about 26 per cent., on Tyneside and at Sheffield 20 per cent., at Leeds 18 per cent., at Bradford 15 per cent., and at Manchester 10 per cent. (numerical increase at Manchester over a million). At Birmingham, following the introduction of the 6d. telegram on May 31st, there was an average increase in traffic of 28 per cent. up to the end of the year, the total number of transactions being 10,456,341.

Contract Information

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses

Contracts Open

Aberystwyth.—March 30th. Electricity Department. Underground cables, feeder and distribution pillars and disconnecting boxes. (March 13th.)

Argentina.—BUENOS AIRES.—April 13th. State Oilfields Directorate. Diesel engines and generating sets. (T.Y. 5790.)*

Australia.—HOBART.—April 20th. Municipal Tramways. One 11,000-V three-phase, 750-kW, a.c. to d.c. rotary convertor or rectifier. (T.Y. 10412.)*

Barnes.—April 14th. Electricity Department. Mercury-vapour rectifier plant. (See this issue.)

Beckenham.—March 23rd. Borough Council. Meters and cookers for one year. (March 13th.)

Bexhill.—April 3rd. Electricity Department. Materials for one year. (See this issue.)

Birmingham.—March 25th. Electric Supply Department. A.c. and d.c. distribution boards. (March 13th.)

April 1st. Two 1,000-kVA transformers. (See this issue.)

Brighton.—March 23rd. Borough Council. Electric lighting in one block at the Municipal Hospital. W. N. C. Clinch, engineer and manager, "Electric House," Castle Square (deposit £1 1s.).

Bromley.—March 23rd. Electricity Department. Cables. (March 13th.)

Caerphilly.—April 6th. Electricity Department. E.h.p. truck type cubicle, kiosk, transformer, e.h.p. circuit-breaker and l.p. gear, e.h.p. and l.p. cables, &c. (See this issue.)

Cheadle & Gatley.—April 8th. Electricity Department. 6.6-kV feeder. (See this issue.)

Clitheroe.—March 23rd. Electricity Department. Wood Poles. (March 6th.)

Dartford.—March 23rd. Cable. (March 13th.)

Dundee.—March 23rd. Education Committee. Electric Lighting and clock installations at St. Mary's R.C. (Girls) new school. J. A. F. Morrison, city quantity surveyor, 21, City Square.

April 7th. Electricity Department. General engineering stores for one year. D. H. Bishop, general manager and engineer, Dudhope Crescent Road. Meters for one year. (See this issue.)

Dunfermline.—March 30th. Town Council. Electric lighting in 150 houses. D. H. Shaw, borough surveyor, City Chambers (deposit £1 1s.).

Egypt.—CAIRO.—April 30th. Ministry of the Interior. 525 single-phase and seventy-five three-phase electricity meters. (T.Y. 10434.)*

April 30th. Public Works Department. Electrical material, including lamps, domestic wiring supplies, battery plates, house-service meters, street lighting poles and lanterns. (T.Y. 10436.)*

Glasgow.—March 21st. Public Health Department. Supplies, including electrical fittings, at hospitals for one year. Superintendent of Stores, 25, Montrose Street.

Gloucester.—March 30th. Street lighting equipment and lanterns for sodium street lighting. (See this issue.)

Great Yarmouth.—March 26th. Electricity Supply Department. Materials for one year. (March 6th.)

Grimsby.—April 1st. Electricity Department. Two 6.6-kV switchboards, three transformers and two l.p. switchboards. (See this issue.)

Hyde.—March 25th. Corporation. Electric lamps for twelve months ending March 31st. 1937. Borough surveyor, Town Hall.

Kirkcaldy.—March 24th. Corporation. Electric lighting of 276 houses. G. B. Deas and T. Bertram, Central Chambers (deposit £1).

London.—LONDON & HOME COUNTIES J.E.A.—April 6th. Annual supply of general electrical accessories. (March 13th.)

METROPOLITAN WATER BOARD.—April 17th. Two high-compression heavy fuel oil engines with centrifugal pumps and electrical generators, three electrically driven bore-hole pumps, switchboard, &c., at the Shortlands Pumping Station, Kent. Chief engineer, Room 235, 173, Rosebery Avenue, E.C.1 (deposit £2 2s. to the Accountant to the Board.)

STOKE NEWINGTON.—Electricity Department. Transformers, e.h.p. and l.p. switchgear. (March 13th.)

Manchester.—March 25th. Electricity Committee. Service cut-outs and cables for one year. (March 6th.)

March 23rd. Oil-immersed reactors, transformers, switchboard and fire-extinguishing equipment. (March 6th.)

April 9th. Static transformers for one year. (March 13th.)

Middlesex.—April 27th. County Council. Electrical installation at extensions to the Redhill County Hospital, Edgware. (See this issue.)

New Zealand.—WELLINGTON.—May 22nd. Post and Telegraph Department. Telephone switchboard cable. (T.Y. 10430.)*

AUCKLAND.—April 28th. Harbour Board. Three 5-ton electric capstans. C. R. Butters, 100, Clifden Road, E.5 (deposit £2 2s.).

Oldham.—March 23rd. Electricity Committee. Cable. (March 13th.)

March 24th. Public Libraries, Art Gallery and Museum Committee. Electric lift at the Central Library. Borough engineer and surveyor's Office, Town Hall (deposit £1 1s.).

Pontardawe.—March 30th. Electricity Department. Materials for one year. (March 13th.)

Portsmouth.—March 30th. Electricity Department. Substation e.h.p. and l.p. switchgear and steel kiosks with switchgear for one year. (March 6th.)

Salford.—March 25th. City Council. Electrical installations in 292 flats in Eccles New Road. City electrical engineer, Electricity Department, Frederick Road.

Southport.—March 31st. Electricity Department. Transformers. (See this issue.)

Watford.—March 23rd. R.D.C. Three electrically driven centrifugal pumps (one 20,000 gal per hr. and two 6,000 gal. per hr. each), and one oil-engine-driven pump with accessories for the Aldenham sewage works. Howard Humphreys & Sons, 17, Victoria Street, London, S.W.1 (deposit £2 2s.).

West Ham.—April 4th. Electricity Department. 6.6-kV switchgear for one year. (See this issue.)

Weymouth and Melcombe Regis.—March 30th. L.p. cable. (March 13th.)

Whalley (NR. BLACKBURN).—March 30th. Electric lamps for twelve months for the Calderstones Mental Institution. C. P. Hargreaves, clerk and steward.

Whittingham (NR. PRESTON).—March 25th. Committee of Visitors for the County Mental Hospital. Electric lamps for twelve months to March 31st, 1937. J. Rupert Bishop, clerk and steward.

Worthing.—March 23rd. Water Department. Electrically operated automatic booster pumping plant at Sompting. Water engineer, Town Hall, Chapel Road (deposit £2 2s.).

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*Further particulars from the Department of Overseas Trade (Inquiry Room), 36, Old Queen Street, London, S.W.1.

Contracts Closed

Cardiff.—Electricity Committee. Accepted. Transformers. Six 500-kVA (£1,333).—Ferranti, Ltd. Four 250-kVA (£457).—General Electric Co., Ltd.

Clacton-on-Sea.—U.D.C. Accepted. Two transformers (£366).—Crompton Parkinson, Ltd.

Fife.—C.C. Finance Committee. Accepted. Electric lighting at the new Dunfermline High School (£1,051) and at the Buckhaven Junior Instruction centres.—Moncrieff Bros., Leven.

Hastings.—Electricity Committee. Recommended. Switchgear.—Ferguson, Pailin, Ltd. (£850); Crompton Parkinson, Ltd. (£310); English Electric Co., Ltd. (£1,000); A. Reyrolle & Co., Ltd. (£1,250). Cables.—W. T. Glover & Co., Ltd. (£12,400); Mersey Cable Works, Ltd. (£600); Crompton Parkinson, Ltd. (£450). House service meters (£7,000).—Metropolitan-Vickers Electrical Co., Ltd. Service boxes, &c. (£1,500).—British Insulated Cables, Ltd. Joint boxes, &c. (£1,200) and copper wire, &c. (£3,838).—W. T. Glover & Co., Ltd. Cut-out sets.—Siemens Electric Lamps & Supplies, Ltd. (£300); W. Lucy & Co., Ltd. (£200). Voltage regulator (£472).—Ferranti, Ltd.

Hove.—Town Council. Accepted. Supplies for the year ending March 31st, 1937: Cables, service boxes, compounds and feeder pillars.—Callender's Cable & Construction Co., Ltd. Fuse boxes, sealing chambers and connector boxes.—W. Lucy & Co., Ltd. Service boxes and insulating tape.—W. T. Henley's Telegraph Works Co., Ltd. Bitumen.—Shell-Mex & B.P., Ltd. Meters.—Ferranti, Ltd.; Measurement, Ltd.; Metropolitan-Vickers Electrical Co., Ltd. Maximum demand indicators.—Reason Manufacturing Co., Ltd. Time switches.—Horstmann Gear Co., Ltd. Cookers.—General Electric Co., Ltd.; English Electric Co., Ltd. Cooker control panels.—M. K. Electric, Ltd. Electric kettles.—Bulpitt & Sons, Ltd. Electric irons.—Revo Electric Co., Ltd. Wash-boilers.—Burnley Components, Ltd. Water heaters.—Simplex Electric Co., Ltd.

Lincoln.—Electricity Department. Accepted. Supplies for the year ending March 31st, 1937: P. and r.i. cables, Callender's Cable and Construction Co., Ltd. Electric cookers, Jackson Electric Stove Co.; Revo Electric Co., Ltd. Underground joint boxes and house service cut-outs, W. T. Henley's Telegraph Works Co., Ltd. Meters.—Aron Electricity Meter, Ltd.; Venner Time Switches, Ltd.; Metropolitan-Vickers Electrical Co., Ltd.; Chamberlain & Hookham, Ltd.; Ferranti, Ltd. Joint box compounds.—Dussek Bitumen Co.

London.—L.C.C. Change-over of electricity supply at the Poplar Institution:

	£
City Electrical Co. Accepted	**1,660**
Pinching & Walton	1,875
Malcolm & Allan (London), Ltd.	1,891
G. E. Taylor & Co.	1,941
T. Clarke & Co., Ltd.	1,953
W. J. Furse & Co. (London), Ltd.	2,023
H. J. Cash & Co., Ltd.	2,077
Arthur Cozens	2,095
Electrical Installations, Ltd.	2,147

Accepted. Wiring and fittings for electric fire-alarm system at Dulwich Hospital (£581).—L. G. Tate & Co., Ltd. This was the lowest of eleven tenders, the highest being £796. Wiring and fittings for electric lighting at the Linden Lodge residential school for Blind Boys (£465).—E. C. Sparkes & Co.

Two electric stretcher lifts at blocks "G" and "H," Hammersmith Hospital:

	£
Pickerings, Ltd. Accepted	**1,525**
Waygood-Otis, Ltd.	1,772
J. & E. Hall, Ltd.	1,860
Express Lift Co., Ltd.	1,908

Wiring and fittings for electric lighting, power, telephones, fire alarms and call bells in new mental unit, St. Pancras Hospital (Institution):

	£
Piggott Bros. & Co., Ltd. Accepted	**721**
Wiring, Ltd.	825
J. E. Swann & Co., Ltd.	844
Frank Angell & Co., Ltd.	883
W. H. Gaze & Sons, Ltd.	888
Francis Polden & Co., Ltd.	895
Buchanan & Curwen, Ltd.	915
Keeble, Ltd.	1,276

Wiring and fittings for electric lighting, power, &c., in blocks "G," "H" and "I," Hammersmith Hospital:

	£
T. Clarke & Co., Ltd., Accepted	2,750
Pinching & Walton	2,909
G. E. Taylor & Co.	2,980
H. J. Cash & Co., Ltd.	2,986
Read & Partners, Ltd.	3,021
City Electrical Co.	3,113
A. Dean & Co., Ltd.	3,126
A. Hawkins & Sons	3,179
W. J. Furse & Co. (London), Ltd.	3,197
Electrical Installations, Ltd.	3,452

Peterborough.—Corporation. Accepted. Electrical work at the open-air swimming pool (£296).—Peterborough General Electric Co., Ltd.

Slough.—U.D.C. Accepted. Electric lighting at the new Council Offices (£240).—W. G. Bedford.

Southport.—Electricity Committee. Accepted. Mercury arc rectifier (£395).—Hewittic Electric Co., Ltd. Switchgear.—Crompton Parkinson, Ltd. (£768); Whitehead Switchgear, Ltd. (£430).

South Shields.—Transport Committee. Accepted. Trolley vehicle sub-station equipment (£1,280).—Hewittic Electric Co., Ltd. L.p. cable (£871).—W. T. Glover & Co., Ltd. Trolley wire.—British Insulated Cables, Ltd.

Staines.—Middlesex C.C. Accepted. Electrical installation at kitchen block of the Institution (£512).—G. A. Weston.

Sunderland.—Town Council. Accepted. Switchgear for the Whickham Street sub-station (£416).—A. Reyrolle & Co., Ltd.

Swansea.—Electricity Committee. Accepted for twelve months:—Bitumen and compound.—Dussek Bitumen & Taroleum, Ltd.; Western Trinidad Lake Asphalt Co., Ltd. Cable boxes.—Callender's Cable & Construction Co., Ltd.; W. Lucy & Co., Ltd. Cable.—Callender's Cable & Construction Co., Ltd.; Pirelli-General Cable Works, Ltd. Transformers.—Electric Construction Co., Ltd.; Hackbridge Electric Construction Co., Ltd. Meters and demand indicators.—Aron Electricity Meter, Ltd.; Crompton Parkinson, Ltd.; Electrical Apparatus Co., Ltd.; Ferranti, Ltd.; R. Hornby & Co., Ltd.; Metropolitan-Vickers Electrical Co., Ltd.; Price & Belsham, Ltd.; Reason Manufacturing Co., Ltd.; Siemens Electric Lamps & Supplies, Ltd. Motors and starters.—Brook Motors, Ltd.; Morecambe Electrical Equipment Co., Ltd. Time switches.—General Electric Co., Ltd.; R. Hornby & Co., Ltd.; Horstmann Gear Co., Ltd.

Wallasey.—Electricity Committee. Accepted. Four 100-kVA transformers (£248).—Yorkshire Electric Transformer Co., Ltd. Cable (£264).—British Insulated Cables, Ltd.

Forthcoming Events

Institution of Electrical Engineers.—Monday, March 23rd. Institution, London. 7 p.m. Informal meeting. Discussion on "Electricity Supply to, and the Equipment of, Trolley-buses." To be opened by Mr. J. H. Parker.

Meter and Instrument Section.—Friday, March 20th. Institution, London. 7 p.m. Informal meeting. Discussions on "Whether the Section is Fulfilling its Objects." To be opened by Mr. E. E. Sharp. "Insulated v. Metal-cased Meters." To be opened by Mr. A. J. Pitt. "What Economic Low-load Limit Should Determine the Removal of a Meter from Service?" To be opened by Mr. G. F. Shotter.

North-Eastern Centre.—Monday, March 23rd. Armstrong College, Newcastle-upon-Tyne. 6.15 p.m. "Tariffs for Domestic and Business Premises." Mr. B. Handley.

North-Western Centre.—Tuesday, March 24th. Engineers' Club, Manchester. 7.15 p.m. "The High-pressure Mercury Vapour Lamp in Public Lighting." Messrs. G. H. Wilson, E. L. B. Damant and J. M. Waldram.

Scottish Centre.—Tuesday, March 24th. North British Station Hotel, Edinburgh. 7 p.m. "Switchgear: Overall Short-circuit Performance." Mr. G. Caton.

Wireless Section.—Tuesday, March 24th. Institution, London. 6.30 p.m. Informal meeting. Discussion on "Loudspeakers and Sound Reproduction." To be opened by Mr. P. K. Turner.

Tees-Side Sub-Centre.—Wednesday, March 25th. Annual dinner.

Irish Centre.—Thursday, March 26th. Gaiety Theatre, Dublin. 4 p.m. Faraday Lecture. "Television—An Outline." Mr. E. Mallett.

West Wales (Swansea) Sub-Centre.—Thursday, March 26th. Chamber of Commerce, Swansea. 6.30 p.m. "The Effect of Legislation and Regulations upon Electricity Distribution." Mr. W. Fennell.

London Students' Section.—Friday, March 27th. Institution, London. Informal discussion. "Are Present-day Domestic Electrical Appliances Adequate?"

Batti-Wallahs' Society.—Friday, March 20th. Hotel Metropole, London, W.C.2. Annual dinner and dance, Thursday, March 26th. Hotel Metropole. 12.30 for 12.55 p.m. Luncheon. Address by Sir Clement Hindley.

British Westinghouse Association.—Friday, March 20th. Trocadero Restaurant, London, W.1. 6.30 p.m. Annual dinner. Address by Mr. J. C. Whitmoyer (chairman).

Electrical Development Association.—Friday, March 20th. Savoy Hotel, London, W.C.2. 12.45 for 1 p.m. Annual luncheon.

Association of Mining Electrical Engineers (*South Wales Branch*).—Saturday, March 21st. Cardiff. "Maintenance and Testing of Electrical Plant Including Protective Systems." Mr. H. C. Davies.

Finsbury Technical College Old Students' Association.—Saturday, March 21st. Trocadero Restaurant, London, W.1. 6.30 for 7 p.m. Annual dinner.

Illuminating Engineering Society.—Tuesday, March 24th. Trocadero Restaurant, London, W.1. Dinner.

Electrical Power Engineers' Association (*Birmingham and District Section*).—Friday, March 27th. Edgbaston Assembly Rooms, Birmingham. 7 for 7.30 p.m. Annual dinner and dance.

Notes

Dust Precipitation at Birmingham

On April 2nd members of the National Smoke Abatement Society will meet at the Town Hall, Birmingham, to hear a descriptive address by Mr. F. Forrest, city electrical engineer, on the electrical flue-dust precipitation plant which has recently been installed at the Corporation's electricity generating stations at Hams Hall and Nechells. Following the address members will proceed to the power stations to inspect the new equipment.

The Electrical Association for Women

From the moment they register at the Regent Street headquarters on Wednesday, May 13th, till the following Saturday afternoon delegates to the Association's eleventh annual conference will have little leisure time if they take full advantage of the excellent programme arranged. On the Wednesday evening there will be an informal reception by the London Branch Committee at Prince's Galleries, Piccadilly. A new campaign for the training of domestic servants in the use of electricity will be introduced at the annual general meeting to be held at the Park Lane Hotel on the following morning. After luncheon the branch session will follow, when the work and development of the Association's sixty-eight branches will be discussed, while in the evening the National Executive Committee will hold a reception at the Institution of Electrical Engineers, an address on "The Liberation of the Electron: Its Effect on Every-day Life," being given by Mr. C. C. Paterson. Most of Friday will be occupied by a visit to Northmet House and tours of the company's rural supply areas. There will be a ball at the Park Lane Hotel, in the evening, and for Saturday several visits have been arranged.

In a lecture on "Electrical Influences on Architecture and Decoration" given to the Croydon and District Branch of the Electrical Association for Women (chairman, Mrs. Rendell Baker) on March 10th Mr. G. Francis, of E.D.A., said that lighting fittings must be designed and the whole question of the disposition of light must be arranged to harmonise with the changing style of architecture.

The annual general meeting of the Hull and East Riding Branch took place on March 11th, Mr. J. N. Waite (general manager and engineer) presiding in the absence of Mrs. B. Pearlman. The North-East Coast Branch (which now has a membership of 228) also held its annual meeting at Newcastle on March 13th, when it was announced that Mrs. Haycroft was succeeding Miss Anna Holm as hon. secretary.

A branch of the Association has been inaugurated at Sunderland with Mrs. Stanley Ritson as president; Miss W. J. E. Moul, vice-president; and Mrs. G. S. Hebblesthwaite, chairman. The secretary is Miss Green.

The E.A.W. examination in electrical housecraft will be held on June 18th. (See our classified advertisements.)

New Loughborough H.V. Laboratory

The new million-volt laboratory at Loughborough College was officially opened on March 14th, when the public was admitted to witness the testing of dielectrics. The building has an area of 58 ft. by 39 ft., and a height of 30 ft. The high-voltage apparatus is so interlocked that switching cannot take place until various safety barriers are closed, upon which warning notices are automatically illuminated. The laboratory also houses the extensive X-ray equipment. Both a.c. and d.c. are supplied from the college generating station and, in addition, high-voltage d.c. generators and high-frequency motor-driven alternators are housed in an annexe. When the scheme is completed investigations up to 1,500,000 V will be carried out.

Supervisors' Paper Competition

The Association of Supervising Electrical Engineers announces the thirteenth annual competition for the Highfield Shield, in addition to cash prizes, for the best papers (not exceeding 2,000 words in length) submitted by August 24th.

Appointments Vacant

Telegraph inspectors for the Palestine Posts and Telegraphs Department.

Sales service engineer and two lady demonstrators for Fulham Electricity Department.

Assistant master in mathematics, &c., instructors and assistant instructors in woodwork and metal work, for South-East Essex Technical College, Dagenham.

Civilian technical officers in the Admiralty Technical Pool for the Department of Scientific Research and Experiment, Admiralty.

Sales engineer for the Yorkshire Electric Power Co.

Switchboard attendant for the North-West Midlands J.E.A.

(See our classified advertisements.)

Electricity on the Farm

In an inquiry into tariffs for farmers referred to in *The Times* the rates offered by twenty-seven rural supply undertakings were applied to a typical 40-cow dairy farm with a consumption of 6,440 kWh per annum. For nineteen undertakings the average price per kWh. under two-part tariffs was between 1d. and 2d., fourteen being below 1.6d., and five

Our Personal Column

Electrical men are invited to keep readers of the "Electrical Review" posted concerning their movements

Mr. J. A. Bell, electrical engineer to the Aberdeen Corporation, is due to retire on April 30th, but he has been asked to continue in office until July 31st. The retiring allowance to which he would be entitled under the superannuation scheme is £558, but the Finance Committee has recommended that the allowance should be fixed at £600 per annum.

Under the Order in Council dated February 6th, 1928, the Lord President of the Council has appointed **Professor A. C. Seward,** Sc.D., D.Sc., LL.D., F.R.S., to be a member of the Advisory Council to the Committee of the Privy Council for Scientific and Industrial Research.

Mr. J. P. Tucker, engineer to the Isle of Man Electricity Board, has been provisionally appointed electrical engineer at Loughborough, at a salary of £750 per annum, in succession to Mr. M. J. Mortimer, who is going to Worthing.

Four members of the North of England Branch of the Association of Mining Electrical Engineers who have been national presidents of the Association were presented with a replica of the president's badge at the annual dinner of the branch at Newcastle on March 14th. The presentations were made by Mr. A. W. Williams (President) to **Professor W. M. Thornton,** of Armstrong College, Newcastle; **Mr. G. Raw,** consulting engineer, of Newcastle; **Mr. H. J. Fisher,** now retired and for many years with the Lambton, Hetton, and Joicey Collieries, Ltd.; and **Mr. S. Walton-Brown,** agent to the Seghill Colliery, Ltd.

Mr. A. V. Perry has been appointed a director of the Ever Ready Trust, Ltd.

M. André Claude, director of the Société Claude, Pax & Silva, of Paris, specialists in neon lighting, has lately been appointed a Chevalier of the French Legion of Honour.

Mr. E. S. Wade has resigned from the board of Messrs. Gabriel Wade & English, Ltd.

Mr. A. D. Shroff has been elected to the board of the Tata Power Co., in succession to the late Mr. F. E. Dinshaw.

Dr. G. A. Campbell has retired from active membership of the staff of the Bell Telephone Laboratories, New York, after thirty-eight years' service as a mathematical physicist and inventor. According to the *Telegraph and Telephone Age*, Dr. Campbell and the late Prof. M. Pupin each devised a complete theory of the telephone loading coil. They both applied for patents, Prof. Pupin being able to establish a slightly earlier date of conception. Dr. Campbell's work in this field was outstanding, however, and he had much to do with the success of the new invention, formulating the rules for the design of loading coils and their spacing, which were, from the very beginning, the only ones employed in the United States. He was also the originator of the "four wire" type of circuit and other developments.

Mr. W. Woodiwiss A.M.I.E.E., assistant mains engineer with Dundee Corporation Electricity Department, has been appointed mains superintendent with Perth Corporation Electricity Department. He obtained his diploma in electrical engineering at Bradford Technical College, and was awarded first-class honours from the City and Guilds of London in 1923. He went to Dundee in 1926 to take up his present position.

Major J. S. Thain, M.C., formerly chief electrical engineer of the Public Works Department of the Gold Coast Government, has been appointed secretary and manager of a new company formed to take over the wireless relay service at Weston-super-Mare formerly operated by Mr. W. J. Badman.

Mr. G. E. Hoyle, late of Walsall Conduits, Ltd., has joined the London sales staff of the Simplex Electric Co., Ltd.

Mr. R. Cunningham has been appointed manager of the new Liverpool branch of Attwoods (Factors), Ltd.

Mr. A. A. Hughes, chief engineer of the Construction Department of the North Eastern Electric Supply Co., Ltd., has resigned from the company, and after a short holiday is taking up another appointment in London.

Mr. S. B. Warder, export manager to the Asea Electric Co., Ltd., who is resigning from that position to take up an appointment with one of the railway companies in this country, has been presented with a gold cigarette case by his colleagues. The presentation was made by Mr. S. H. Busch, the managing director.

Mr. N. F. T. Saunders, B.Sc., A.M.I.E.E., has resigned his position as chief engineer to H.M.V. Household Appliances, Ltd., and the Domestic Appliance Department of the Gramophone Co., Ltd., in order to take up the appointment of general manager to Icematic, Ltd.

Mr. C. Rushton has been appointed sales manager of Seal Electric Ltd., London, S.W.1.

Obituary

Mr. J. Hamilton.—We regret to record the death of Mr. John Hamilton, deputy city electrical engineer at Liverpool, which occurred on March 10th at the Royal Infirmary, Liverpool, at the age of fifty-one years. Mr. Hamilton served his apprenticeship in mechanical engineering with Messrs. G. & J. Weir, Ltd. He joined the Glasgow Corporation Electricity Department as an engineer-in-charge, and in 1912 was appointed to the staff of the Liverpool electricity undertaking as an assistant engineer, becoming station superintendent at Lister Drive in 1917. He was appointed superintendent engineer of generation at Liverpool in 1928, acting as resident engineer during the construction of Clarence Dock station and became deputy electrical engineer in January last year. The interment took place at Anfield Cemetery on Friday last.

The late Mr. J. Hamilton

Notes *(Continued from preceding page)*

above 2d., the highest being 2.29d. Two municipalities, supplying an adjoining prosperous rural area, and one company supplying a residential area offered a rate below 1d. Of the undertakings supplying a rural area proper (with no urban association) the lowest figure was 1.37d. It is considered that for motors of 4 to 10 h.p. in use for less than 750 hours per annum, 1½d. per kWh is competitive with a diesel. Motors of from 1 to 3 h.p. for milking, pumping and incubators can compete with petrol and paraffin engines up to 2d. per kWh, at which price water can be supplied much more cheaply than from a rural main water system. Fractional h.p. motors for driving separators and bottle washers work cheaply at 3d. or 4d. per kWh. Low-grade heat for rooms, water, sterilising and hover-heating is dear at more than ¾d., but sometimes the advantages of electricity may justify its use up to 1¼d. High-grade heating, as in cabinet incubators, is sound at 1d. Domestic cooking is reasonably competitive with oil up to 1d. or 1¼d., and with coal on cost alone at ½d. to ¾d. Lighting at 9d. per kWh is cheaper than oil for the same amount of light.

The B.S.I. Handbook

The British Standards Institution has issued its half-yearly handbook which includes the indexed list of current British Standard Specifications to January 1st, 1936, and special reports on standardisation in the mechanical engineering industry and in the iron and steel industry. A new feature of the handbook is the index to the methods of test contained in British Standard Specifications, which tests have a use apart from the specifications. Copies of the new handbook (reference CD.9000) are available from the British Standards Institution, Publications Department, 28, Victoria Street, London, S.W.1, price 1s. 4d. post free.

I.E.E. Scholarships

Applications, which must be received not later than April 15th, are invited for the Duddell, Ferranti, Swan, Thompson and Esson scholarships (two of which may be travelling) awarded by the Institution of Electrical Engineers, Savoy Place, Victoria Embankment, W.C.2, from which full particulars are obtainable. The first award of the William Beedie Esson scholarship, valued at £120 per annum for two years and renewable in approved cases for a third year, which has been founded by Mrs. Esson, will be made this year.

I.E.E. (Meter and Instrument Section)

The summer visit of the Meter and Instrument Section of the Institution of Electrical Engineers will be held in Oxford and district on May 2nd. The programme will include a visit to the Cowley works of Morris Motors, Ltd., the inspection of two of the Oxford colleges and a steamer trip over the Oxford University rowing course.

Our Service Department

EVERY day inquiries of all kinds are received by the Editors, the bulk of them relating to the producers of specified classes of electrical goods. We are able to reply to most of these with the aid of our extensive records, but in a few cases we have to seek the assistance of our readers. This week we have been asked for the names and addresses of manufacturers of the following:—

VERTREX panel heating.
PARAMOUNT advertising turntable.
DUMBRILL dough mixer.
INVINCIBLE electric iron.
UVRAL ultra-violet ray apparatus.

Readers should enclose stamped addressed envelopes when making their inquiries.

Mr. T. E. Bingham.—The death occurred on March 6th, in his sixty-fifth year, of Mr. T. E. Bingham, managing director of Messrs. Barber & Colman. Mr. Bingham had been connected with the company for more than thirty years.

Mr. R. A. Chattock.—We learn with regret the death of Mr. R. A. Chattock, M.Sc., M.I.E.E., chairman of Electric & Gas Industries, Ltd., which occurred on March 14th in London at the age of seventy. Mr. Chattock will be best remembered by his long association with the Birmingham Corporation Electric Supply Department, of which he was chief for twenty-six years, retiring from that position in 1929. He was educated at University College, London, and served his apprenticeship as a mechanical engineer at the Blackwall Ironworks. He obtained his first experience with the Metropolitan Electric Supply Co., with whom he held the position of assistant engineer. Later he became superintendent engineer of the Bankside power station of the City of London Electric Lighting Co., a position which he held until 1900, when he was appointed city electrical engineer of Bradford. He was three years at Bradford, and on the acquisition by the Birmingham Corporation of the electricity supply undertaking, then under company management, Mr. Chattock was appointed to the chief executive office. Whilst at Birmingham, Mr. Chattock was responsible for the designing, erection and equipping of the generating stations at Summer Lane, Nechells, and Hams Hall. He was closely identified with various professional organisations, and in 1925 he was elected president of the Institution of Electrical Engineers. He was also a past-president of the I.M.E.A.

[Lafayette
The late Mr. R. A. Chattock

Professor J. S. Haldane, C.H., F.R.S., who died at Oxford last Saturday at the age of seventy-five, was probably best known to the public for his investigations into respiration, which have profoundly influenced modern physiological views. During the war he was engaged in devising means for counteracting the effects of poison gas. His interest in the functions of gases and liquids in the human organism led him to a study of the physics of gases and liquids generally, and thence to formulating theories of heat engines, which formed the subjects of published works. Ventilating problems provided him with another subject of engineering associations, and he was retained in connection with the ventilation of the Mersey Tunnel. For many years Professor Haldane served as a Board of Trade gas referee. His researches regarding safety in mines brought him into touch with electrical matters, but perhaps his most notable connection with the electrical world was in relation to power station chimney emissions, on which he gave expert evidence at the official inquiry into the application of the London Power Company for consent to the erection of Battersea generating station.

Will.—Mr. J. A. Crabtree, head of Messrs. J. A. Crabtree & Co., Ltd., left £493,033, with net personalty £408,579. Estate duty of £138,809 has been paid. Mr. Crabtree left £2,000 to the Walsall General Hospital, and bequests to various relatives, friends and members of the staff of the company, including £500 to his private secretary, Frances Annie Wallace. To employés of one year's service he left one week's wages. To his widow he left £5,000 and his household and personal effects, and the residue of his property as to one-fourth in trust for her life. The ultimate residue of his property he left to his children or their issue.

Financial Section

New Companies. Official Returns of Capital. Debenture Charges. Reports of Electrical Companies. Dividend Announcements. Transactions in Stocks and Shares

New Companies Registered

Worsdall Mercury Controls, Ltd.—Private company. Registered March 11th. Capital, £11,000. Objects: To acquire from H. Worsdall, J. C. Harvey and A. Harvey British letters patent and applications for British letters patent for mercury fuses and mercury electric controls and to carry on the business of electrical, radio, civil and mechanical engineers, &c. The directors are: H. G. Blundell, "Highclere," Batchworth Lane, Northwood, and five others. Registered office: Africa House, Kingsway, W.C.2.

Cowley Radio, Ltd.—Private company. Registered March 11th. Capital, £500. Objects: To acquire the business of an electrical and radio engineer now carried on by Dorothy M. Longthorpe at 445, Cowley Road, Oxford, as "D. M. Evans & Co." The permanent directors are: D. M. Longthorpe, 445, Cowley Road, Oxford; and F. H. Ayres, 34, Southdale Road, Summertown, Oxford. Solicitors: Horace Fisher & Cole, 131, High Street, Oxford.

Kessel (Power Plant), Ltd.—Private company. Registered March 13th. Capital, £5,000. Objects: To carry on the business of electrical, steam, oil, water, gas and mechanical power engineers and manufacturers of and dealers in all kinds of electrical, steam, oil, gas and mechanical goods and equipment, &c. The subscribers are: H. C. Wisenden, 114, Hillside Gardens, Barnet; and A. Wilson, 62, Myddelton Square, E.C.1. Solicitors: Zeffertt & Heard, 17, Coleman Street, E.C.2.

Home Electric-Washer Co., Ltd.—Private company. Registered March 11th. Capital, £100. Objects: To carry on the business of dealers in and users of electric washing machines and other domestic and household appliances, &c. The first directors are: H. R. Wilkins, The Hollies, Hollies Drive, Wednesbury; and L. R. Hall, 169, Sudbury Heights Avenue, Greenford. Registered office: 27, Grosvenor Place, S.W.

V. W. C. Jupp & Co., Ltd.—Private company. Registered March 9th. Capital, £2,000. Objects: To carry on the business of electricians, electrical contractors and mechanical engineers, dealers in radiators, dealers in and retailers of ironmongery, sports goods, &c. The subscribers are: V. W. C. Jupp and Mrs. J. T. Jupp, both of "Three Ways," Brixworth. Solicitors: Ray & Vials, 18, Market Square, Northampton.

T. W. Ashworth, Ltd.—Private company. Registered March 9th. Capital, £100 in £1 shares. Objects: To carry on the business of wireless distributors, manufacturers of and dealers in wireless and electrical equipment, &c. The directors are: T. W. Ashworth and E. Ashworth, both of 131, Foregate Street, Chester. Secretary: F. Finnigan. Registered office: 41, Castle Street, Liverpool, 2.

P. J. Haskins, Ltd.—Private company. Registered March 13th. Capital, £1,000. Objects: To acquire the business of an electrical and radio engineer carried on by P. J. Haskins at 5, High Street, Weston-super-Mare. The first directors are: P. J. Haskins and Mrs. M. J. Haskins, both of 5, High Street, Weston-super-Mare. Solicitors: Baker & Co., Weston-super-Mare.

Globe Radio, Ltd.—Private company. Registered March 14th. Capital, £100. Objects: To buy, sell and deal in, either as factors or agents, wireless sets and receivers, loud speakers, valves and components, &c. The subscribers are: T. W. Westrop, 40, Gayfere Road, Ewell, Surrey; and W. Davidson, 29, Viaduct Street, Bethnal Green, E.2. Registered office: 15, Thavies Inn, E.C.1.

Wireless Development, Ltd.—Private company. Registered March 12th. Nominal capital, £1,000. Objects: To carry on business as advertising contractors and publicity agents; to purchase time (and to lease it) from broadcasting stations, to arrange wireless transmissions generally, to act as concessionaires, agents, managers, and organisers of wireless broadcasting stations in England and abroad. The subscribers are: S. M. Edmonds, 21, Drylands Road, N.8; and E. Addison, 11, Francis Road, Kenton. Solicitor: Roger J. Quin, 52, New Broad Street, E.C.

Returns of Electrical Companies

West of England Electric Investments, Ltd.—Particulars have been filed of debenture stock to secure £500,000 (with power to issue further stock provided that the total shall not exceed the paid up capital), authorised December 9th, 1935, and covered by trust deed dated February 27th, 1936. Property charged: the company's undertaking and property, present and future, including uncalled capital. The amount of the present issue is £500,000. Trustees: Whitehall Trust, Ltd.

Devon Electric & General Services, Ltd.—The nominal capital has been increased by the addition of £30,000 in £1 ordinary shares beyond the registered capital of £5,000. At November 29th, 1935, Leonard K. Elmhirst held 2,996 shares out of 3,000 issued. The directors are: L. K. Elmhirst, W. K. Slater and Dorothy W. Elmhirst (all directors of Dartington Hall, Ltd.); Albert E. Malbon (director of Staverton Builders, Ltd.); A. O. Elmhirst, F. A. S. Gwatkin and Eric S. Porter.

British Central Electrical Co., Ltd.—Issue on November 10th, 1931, of £300 debentures, part of a series already registered. (Particulars of issue filed March 9th, 1936.)

Donovan Electrical Co., Ltd.—Capital, £50,000 in £1 shares. Return dated October 2nd, 1935. 29,100 shares taken up. £29,100 considered as paid. Mortgages and charges, nil.

Weston Electric Lamp Co. (1933), Ltd.—Capital, £200 in £1 shares. Return dated December 4th, 1935. All shares taken up. £200 paid. Mortgages and charges, £550.

Page & Girling, Ltd.—Capital, £2,000 in £1 shares. Return dated November 9th, 1935. All shares taken up. £2,000 paid. Mortgages and charges, nil.

Brush Electrical Engineering Co., Ltd.—Satisfaction to the extent of £44,930, £58,418, and £74,145, respectively, on December 31st, 1931, of trust deeds dated March 14th, 1892, November 1st, 1899, and September 4th, 1908, and registered September 30th, 1908, September 30th, 1908, and September 7th, 1908. Notices filed March 5th, 1936.

Electro Dynamic Construction Co., Ltd.—Charge on freehold land and factory in Station Road, St. Mary Cray, dated March 4th, 1936, to secure all moneys due or to become due from the company to Lloyds Bank, Ltd., not exceeding £4,000.

Zetavox Radio & Television, Ltd.—Satisfaction to the extent of £10,000 on November 1st, 1934, of debenture dated April 21st, 1933, and registered May 6th, 1933. (Notice filed March 5th, 1936.)

Adelaide Electric Supply Co., Ltd.—Issue on March 3rd, 1936, of £200,000 4 per cent. "E" consolidated debenture stock, part of a series already registered.

George Nobbs, Ltd. (old company).—C. Waller, 27, Fitzroy Square, W.1, ceased to act as receiver and manager on February 25th, 1936.

Telsen Electric Co., Ltd. (old company).—C. H. Smith, 71, Edmund Street, Birmingham, ceased to act as receiver and/or manager on March 5th, 1936.

Geo. Cooper (Electricians), Ltd.—Capital, £1,000 in £1 shares. Return dated December 31st, 1935. 500 shares taken up. £500 paid. Mortgages and charges, £2,500.

Drake & Gorham Electrolumination, Ltd.—Capital, £200 in £1 shares. Return dated October 9th, 1935. 200 shares taken up. £200 paid. Mortgages and charges, nil.

British G.W.Z. Battery Co., Ltd.—The nominal capital has been increased by the addition of £35,000 in £1 ordinary shares beyond the registered capital of £15,000.

Vince's Dry Batteries, Ltd.—Satisfaction in full on February 19th of debenture dated March 27th, 1934, and registered March 28th, 1934, securing £6,000.

Bell's Porlite and Everite Co., Ltd.—Capital, £100 in £1 shares. Return dated December 28th, 1935. All shares taken up. £100 paid. Mortgages and charges, nil.

Beck & Moss, Ltd.—Debenture dated February 17th, 1936, to secure £400, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: Branch Nominees, Ltd.

Permaheat Safety Cushion Co., Ltd.—Issue on February 19th, 1936, of £400 debentures, part of a series already registered.

Vee Cee Dry Cell Co. (1927), Ltd.—Satisfaction in full on February 22nd, 1936, of debentures authorised June 15th, 1932, and registered June 29th, 1932, securing £5,000.

Direct Spanish Telegraph Co., Ltd.—Satisfaction to the extent of £100,000 on various dates from May 13th, 1926, to February 20th, 1936, of debentures authorised August 14th, 1925, and registered October 1st, 1925.

Whitaker Electric Co., Ltd.—H. Rule, Bush Lane House, Cannon Street, E.C.4, ceased to act as receiver and/or manager on February 27th, 1936.

Shenstone Engineering Co., Ltd.—C. S. Birbeck, Victoria Chambers, Stoke-on-Trent, ceased to act as receiver on February 29th, 1936.

R. J. Raphael & Co., Ltd.—G. C. Moody, 10, Coleman Street, E.C., was appointed receiver on February 13th, 1936, under powers contained in debenture dated March 26th, 1934.

Accumulator Service, Ltd.—L. C. E. Webber, 64, Gresham Street, E.C., was appointed receiver and manager on February 24th, 1936, under powers contained in debenture dated August 14th, 1935.

City Notes

The North-Eastern Electric Supply Co., Ltd., held its annual meeting on Tuesday last, when Mr. R. P. Sloan (chairman), who presided, said that the substantial reductions in prices made to the lighting, domestic and smaller class of industrial consumers during the past year had been more than offset by the extension of the business coupled with improved trade conditions. New connections had been made amounting to 66,694 h.p. (a record), rather less than half of which represented increased domestic supplies and the remainder the growth on the industrial side; at the end of the year the total connections were 990,087 h.p., while to-day they exceeded the million mark, excluding "stand-by" supplies to large industrial undertakings. Nearly 18,000 new consumers had been added and supplies to the country districts continued to expand. For dealing with these supplies the mains had been extended by 115 miles and the total length of lines established for this purpose was now 865 miles. Much had been said of the difficulties in obtaining supplies in rural areas, but a great deal of progress had been made in their company's districts, and this progress was being maintained; during the past five years nearly £500,000 had been expended on this development. Mr. Sloan referred to the balance sheet and drew attention to an amount of £2,350,645 appearing in the liabilities under "reserve for change of frequency," and said that the new power station at Dunston and certain other assets provided for change of frequency had become the property of the company and the net result, after writing off certain other assets rendered obsolete by the change of frequency, was that the reserve mentioned above had been created. The greater portion of the addition to capital expenditure was represented by these assets, but the company, on the other hand, was responsible for the cost of completing the change subject to a further agreed payment by the Central Electricity Board. With regard to the question of co-ordinating electricity distribution throughout the country he hoped that the investigation which was being underaken by the McGowan Committee would lead to some improvement. As to the future, present indications pointed to continued progress, as most industries to which they were giving supplies were showing an improvement on the 1935 position. It was pleasing to note that there had been an increase in the sales of electricity to the shipyards and marine engine works, as well as to the coalowners in the North East Coast district, who, with a view to effecting economies, continued to spend large sums on electrifying and modernising their collieries.

The Notting Hill Electric Lighting Co., Ltd.—After providing for debenture interest, sinking fund, income tax, &c., the net profit for 1935 amounted to £18,553, as compared with £18,049 for the previous year. The average price per kWh charged to consumers was 2.36d. (the maximum charge was 4.27d.), and this showed "consumers' benefit" amounting to £43,063. A final dividend of 7.0646 per cent. (same) is proposed maintaining the total distribution at 11.0546 per cent. (same). A sum of £12,818 will be carried forward, as against £15,163. Bulk supplies purchased increased from 18,252,725 to 20,309,121 kWh, and the sales of electricity from 15,334,200 to 16,311,838 kWh. Consumers totalled 16,838 (15,226) and connections 28,629 kW (26,750 kW). With a view to closer working with the Metropolitan Electric Supply Co., Ltd., 131,561 ordinary shares out of a total of 135,250 have been exchanged for shares of the Metropolitan Company.

A. Reyrolle & Co., Ltd., are maintaining the ordinary dividend for the year at 12½ per cent.

The County of London Electric Supply Co., Ltd., reports a gross revenue for the year ended December 31st last of £3,820,044, as compared with £3,281,924 in the preceding year. The net revenue is £1,984,611, as against £1,869,096. From this is deducted the following:—Debenture interest, &c., £280,582; provision for difference between issue and redemption price of debenture stock, £4,925; transferred to reserve for depreciation (including contributions to sinking funds), £669,706; taxation reserve, £30,000; general reserve (including (No. 2) fund), £125,000. With £395,188 brought in the balance available is £1,269,575. It is proposed to pay a final ordinary dividend of 7½ per cent., making 10½ per cent. for the year (unchanged) and leaving £387,413 to be carried forward. The sales of electricity amounted to 885,403,070 kWh, as against 776,094,517 kWh in 1934, and in addition 682,302,000 kWh was exported to the Central Electricity Board, as compared with 274,741,000 kWh for the previous year. Further reductions in the electricity charges were made during the year and a special rate for water heating was introduced. Since the last meeting the company has obtained contracts for 257 miles of street lighting. The installation of the additional 75,000 kW set at the Barking power station has proceeded satisfactorily, and it is anticipated that this set will be in operation by the autumn of the current year. The transmission and distribution network was increased by 474 miles of underground mains and overhead lines during the year, while 158 additional transforming stations were put into commission. Meeting: March 24th.

The International Automatic Telephone Co.'s annual report records profits for 1935 amounting to £120,283, as compared with 97,757 in the preceding year. The balance brought forward brings the total to £198,314, from which have to be deducted dividends on the preference shares and the ordinary interim dividend and a transfer of £10,000 to reserve, leaving £153,732 available. The directors recommend a final dividend of 6 per cent. (against 5 per cent.) on the ordinary share, making a total of 9 per cent. for the year (against 8 per cent.) and a dividend of 9 per cent. (against 8 per cent.) on the deferred shares. A sum of £80,320 (£78,031) is to be carried forward. The report adds that the trading activities of the company and its subsidiary company, the Automatic Electric Co., Ltd., showed a satisfactory improvement over 1934.

Pinchin, Johnson & Co., Ltd., report an increase of £41,047 in the net profit (£358,130) for 1935. After providing £56,000 (against £52,000) for income tax and meeting preference and interim ordinary share dividends, it is proposed to pay a final dividend on the ordinary shares of 12½ per cent., making 20 per cent. (against 17½ per cent.), the balance carried forward being raised from £68,143 to £79,837. The net profit mentioned does not take into account the company's share in profits of one of its overseas associates, whose accounts have been delayed but whose profits have been fully maintained and have previously been included in the current year's results. Both in volume and value the company's business has shown substantial expansion at home and abroad, and the manufacturing facilities established in China last year are developing satisfactorily. Of a premium of £60,325 resulting from a new capital issue made in May last, £29,913 has been allocated to special depreciation of capital assets, the net balance bringing the general reserve up to £785,070. Sales for 1936 to date indicate further expansion.

Telephone & General Trust, Ltd.—Presiding at the annual meeting held on Friday last, Sir Alexander Roger (chairman), in the course of his speech referred to the proportion of investments and loans in Great Britain and the Empire, which he said amounted to 24.30 per cent. in 1930 and to-day were 47.05 per cent., while foreign investments and loans which in 1930 represented 75.70 per cent., were to-day 52.95 per cent. The subsidiary companies all showed a profit and the telephone operating companies, in which the company had interests, with one exception continued to improve. The exception was the company which operated the telephone service in Venezuela, where they had been badly hit by the economic depression, but a slight recovery was already noticeable. New telephone investments amounting to £200,000 had been made and these represented the recent acquisition of the telephone companies in Barbados and Trinidad, which was an important step in the scheme for providing a system of telephony and radio-telephony in the British West Indies. The close associations formed in the communication industry generally had extended during the year and a considerable amount of rationalisation was taking place which, it was expected, would yield substantial benefits in due course.

The City of London Electric Lighting Co., Ltd., held its annual meeting on March 18th, when Mr. P. D. Tuckett (chairman), who presided, said that under the heading of "private supply" sales had increased during the year by 9,338,416 kWh, of which 4,247,434 kWh was taken for lighting, 1,325,634 kWh for power, and 3,765,348 kWh for heating. There was also an increase of over 2,500,000 kWh in the quantity taken in bulk by the Southwark Borough Council. The gross sales for the year were thus increased by over 12,000,000 kWh, or 10½ per cent. The price reductions made in April, 1934, resulted in a saving to consumers during that year of £77,000, and during the full year 1935 the saving was £117,000. As a result of this the average price per kWh supplied to private consumers fell to 1.642d. as compared with 1.725d. in 1934 and 1.904d. in 1933. Many of the wiring installations carried out in connection with the floodlighting of public buildings in London as part of the Silver Jubilee celebrations had since been made permanent. Although the Bankside power station now operated under the general direction of the Central Electricity Board, they did everything possible to maintain the efficiency of that station. In supplying electricity to the City they had proof that trade was reviving and they therefore looked forward to the future with confidence.

The Scottish Power Co. reports a revenue from power and lighting companies for 1935 of £332,603, to which is added temporary invesement revenue (£623) and transfer fees (£399), making £333,625. After providing for general expenses, taxation, &c., there is a balance of £302,839. The final ordinary dividend is 5½ per cent., making 8 per cent. for the year, less tax (same), and £8,106 is carried forward.

The Allgemeine Elektricitäts Gesellschaft reports that the revival in business activity continued during the year ended September 30th last. Altogether the turnover represented a value of 273 million Rm., compared with 234 millions in the previous year. The orders received in 1934-35 were of the value of 315 million Rm., 25 per cent. more than in the previous year, and the orders brought over into the current year have correspondingly increased, ensuring work for five months at the present rate of operation. The central station department for the first time for a long period booked a considerably larger number of orders. Special efforts were made to increase export business, but the continued fall in prices caused the value to be only equal to that in 1933-34. As compared with the previous year the financial results for 1934-35 again showed an improvement. The directors state that the foreign exchange obligations of the company show a further decrease, but that the time for financial reorganisation has not yet arrived. As in the previous year the deficit of 57,180,000 marks from the year 1932-33 has again been carried forward.

The Clyde Valley Electrical Power Co. reports a balance of profit for the year ended December 31st last of £410,320, as compared with £384,891 in the preceding year, to which is added £90,700 brought in, making £501,019. A sum of £180,000 is placed to contingency fund, and it is proposed to pay a final ordinary dividend of 5 per cent., maintaining the distribution for the year at 8 per cent., leaving £95,019 to be carried forward. A 30,000-kW turbo-alternator has been installed and is now in commission at Clyde's Mill power station. Contracts will shortly be placed for a unit of similar capacity with boiler plant, &c., to be installed at Yoker power station. The work of changing over the Coatbridge and Airdrie undertakings from d.c. to a.c. is nearing completion. There has been a general increase in the demand from power users and the growth in the number of new domestic consumers connected to the system of the company and its subsidiary, the Strathclyde Electricity Supply Co., Ltd., is satisfactory. Meeting: March 31st at Glasgow.

The Hendon Electric Supply Co., Ltd.—Presiding at the annual meeting on March 16th Mr. C. F. Tufnel (chairman) said that the revenue from the sale of electricity was £242,797, an increase of 9 per cent. on the 1934 figure. Of this revenue 49 per cent. was derived from domestic supplies under the two-part tariff. This tariff had been adopted by 11,832 consumers, who consumed on an average 1,660 kWh, as against 1,610 kWh, at a cost to them of 1.2d., against 1.27d. in 1934. Receipts from the rental of meters and other apparatus on consumers' premises showed a satisfactory increase, and the profit from the sale of lamps, &c., was somewhat better than it was in the previous year. At the end of the year they had 2,533 hire-purchase installations on their books, apart from the L.C.C. and Hendon Council housing estates, and they had over 1,000 pieces of apparatus, such as cookers, fires, &c., out on hire. On the housing estates there were 4,672 houses supplied under assisted wiring schemes.

The Woking Electric Supply Co., Ltd., reports a balance on the year's working for 1935 of £50,838, to which is added interest (£9,203), and the balance brought in (£1,692), making £61,733. After deducting debenture interest, &c., and transferring £21,500 to depreciation and renewals fund and £5,500 to reserve, it is proposed to pay a final ordinary dividend of 5 per cent., making 10 per cent. for the year, tax free, leaving £2,403 to be carried forward. It is also proposed to distribute out of reserves, a bonus of 5 per cent., tax free, on the ordinary shares.

Dublin United Tramways (1896), Ltd., reports a net revenue for 1935 of £57,644, as against £100,050 for the preceding year. The preference dividend is to be met and £20,000 is placed to mortgage and debenture redemption fund. The directors regret, however, that owing to the suspension of services for seventy-six days on account of the withdrawal of labour, the balance does not permit of any ordinary dividend. The amount carried forward is £9,744.

The Salisbury Electric Light & Supply Co., Ltd., reports a balance on the year's working for 1935, after paying debenture interest, &c., and including the amount brought in, of £16,977. It is proposed to place £3,895 to reserve, and to pay a final dividend of 6 per cent., making 10 per cent. for the year, tax free, leaving £582 to be carried forward.

Ericsson Telephones, Ltd., announces a final dividend on the ordinary stock of 10 per cent. and a bonus of 5 per cent., both tax free, making the total distribution for the year 20 per cent., exclusive of a capital bonus of one 5s. share for every £1 share held declared in September last. For 1924 a dividend of 16 per cent. was paid, plus a bonus of 8 per cent., less tax.

The Newcastle & District Electric Lighting Co., Ltd., reports a gross profit for 1935 of £73,296, which with £15,740 brought in makes £89,036. After deducting debenture interest, and placing £29,500 to depreciation fund account, &c., there is a balance of £48,318. The dividend for the year is maintained at 7 per cent., and £15,768 is carried forward.

W. Canning & Co., Ltd., report a profit for 1935 of £71,592, as compared with £62,749 in the previous year, which, with £21,630 brought in, makes £93,222. As announced in our last issue, the final ordinary dividend is 5 per cent., plus a bonus of 12½ per cent., making 22½ per cent. for the year (against 20 per cent.), and £23,910 is carried forward.

The Shropshire, Worcestershire & Staffordshire Electric Power Co. reports a net revenue for 1935 of £707,327, as compared with £679,534 for the preceding year. After deducting debenture interest, &c., and placing £175,000 to reserve, there is a balance of £278,065, to which is added £74,140 brought in, making £352,205. The dividend on the "A" ordinary shares is 8 per cent. for the year (same), on 1,950,000 "B" ordinary shares 6 per cent., and a payment at the rate of 6 per cent. per annum is being made on 500,000 "B" ordinary shares, issued in January, 1935, calculated for the periods from the dates of the respective calls to December 31st last. The amount carried forward is £54,294. The company has acquired the statutory undertaking from the Brecon Corporation. Meeting: March 30th.

The North Wales Power Co. has declared a dividend of 7 per cent., less tax, for 1935 (against 4½ per cent.).

The Oxford Electric Co., Ltd., is maintaining its ordinary dividend for the year at 7 per cent.

The American Telephone & Telegraph Co.'s report states that its total net earnings for 1935 before providing for interest and dividends were $199,900,000, an increase of $17,000,000. The net income available for distribution to stockholders was $132,794,782, or $7.11 per share, compared with $5.96 per share in 1934. The company's surplus at the end of last year was $248,403,000 (including $64,664,000 reserved for general contingencies), while the total assets of the company with those of its associates, which together form the Bell System, amounted to $5,059,000,000, of which $4,266,000,000 was invested in telephone plant.

The Isle of Thanet Electric Supply Co., Ltd., reports a revenue for 1935 of £183,315, as compared with £171,513 in the preceding year, and expenses of £105,270 (against £102,537). After deducting debenture stock service fund, &c., transferring £35,000 to general reserve and depreciation account, and adding £2,984 brought in there is a balance of £26,156. The ordinary dividend for the year is maintained at 4 per cent., and £2,984 is carried forward.

The British Power & Light Corporation, Ltd., has announced a final dividend of 4 per cent. on the ordinary stock, making 6 per cent. for the year. For the previous accounting period of nine months to December 31st, 1934, the distribution was 3¾ per cent. It is intended to offer to ordinary stockholders the right to subscribe for one ordinary £1 share at 25s. for every £5 of ordinary stock held.

The Llanelly & District Electric Supply Co., Ltd., held its annual meeting on March 11th last, when Mr. M. A. Edwards (chairman), who presided, said that the net amount of energy sold by the company and its subsidiary during the year rose by 2,376,646 kWh to 23,311,697 kWh, and the number of new consumers by 2,547 to 15,186.

British Insulated Cables, Ltd., reports a profit for 1935 of £672,591. The ordinary dividend for the year is maintained at 15 per cent., by the final distribution of 10 per cent. and in addition a cash bonus of 5 per cent. is being paid. Reserves and depreciation receive £225,000 and £303,000 is carried forward.

The British Aluminium Co., Ltd.—In a preliminary statement the company reports a profit, including the amount brought in, of £302,227 for 1935, as compared with £222,970 for 1934. It is proposed to maintain the ordinary dividend for the year at 7½ per cent. and to carry forward £62,227.

Associated Electrical Industries, Ltd., proposes to pay a dividend of 8 per cent. on the ordinary stock for 1935 (against 6 per cent. for 1934). The amount of premium on redemption of the 4 per cent. debenture stock redeemed in July last (£103,635) has been provided from the year's profit.

The International Automatic Telephone Co. is paying a final dividend on the ordinary shares of 6 per cent., making 9 per cent. for 1935 (against 8 per cent. for 1934). It is also proposed to pay a dividend of 9 per cent. on the "A" and "B" deferred shares for the year (against 8 per cent.).

Brown Bros., Ltd., report a net profit for the year ended January 16th last of £87,088, as against £79,778 in the preceding year. The final ordinary dividend is 8¾ per cent., making 11¼ per cent. for the year (against 10 per cent.), and £68,862 is carried forward.

Companies Struck Off the Register.—The names of the following companies have been struck off the Register and they are thereby dissolved:—Clark's Neo-Electric Devices, Ltd.; Synchronola Radio Co., Ltd.; Victory Dynamos & Motors, Ltd.

Stocks and Shares

TUESDAY EVENING.

STOCK Exchange markets have been subject to kaleidoscopic changes, due to the constantly-changing conditions of the political outlook. Towards the end of last week, and on Monday morning in the present week, matters in the Stock Exchange markets became very uncomfortable, especially for those people who had bought more stock than they knew comfortably how to finance. A good deal of selling, partly nervous, partly compulsory, took place, with the result that many prices gave way substantially. As an example, Crompton Parkinsons may be quoted as having fallen from 67s. 6d. to 60s., recovering later to 65s. The more complaisant attitude adopted by the German Dictator brought about an all-round recovery and by this, Tuesday, afternoon the markets had almost resumed their normal appearance. A good deal of buying was attracted to the Industrial market. On balance, the falls, though widely-spread, are nothing very serious. It is felt, however, that there will probably be occasional mild shocks during the next few weeks, pending an agreement on the points which contributed to the condition of crisis that prevailed last week.

Electricity Supply Shares

The market in the shares of electricity supply companies has again had the chance to show its comparative imperviousness to the effects of international alarums and excursions. Business has contracted to very small proportions and prices have been, in several instances, marked down a little: but nowhere is there less evidence of selling pressure, and prices are, on the whole, commendably steady. Recent announcements and reports issued by one or two more of the leading supply companies have provided the market with useful support. Of the companies supplying current in and around London, the Metropolitan and the North Metropolitan were shown, at the annual general meetings, to be making sound progress. County of London and London Associated Undertakings both issue reports of higher output and net revenue. Prices of shares in this group are but little changed. County of London ordinary are 1s. higher at 57s., and London Associated 9d. lower at 34s. ex-dividend. The dividends in all these cases are at the same rates as those for the previous year, the distribution of the London Associated Electricity Undertakings conforming with the standard 7 per cent. dividends paid pre-

viously by the six London supply companies which it absorbed.

Newcastle Electrics lost 9d. net to 37s. ex-dividend following publication of the report, which shows some reduction in profits. Declines of 6d. or 1s. are seen in City of Londons, Lancashires, North Easterns and Scottish. Northamptons, at 52s. 6d., and Calcuttas, at 61s. 6d., are each $\frac{1}{16}$ lower. Peraks rallied to 23s. 9d. after being down to 22s. 6d., as compared with 25s. 6d. a fortnight ago. The 6 per cent. dividend announcement made by the British Power and Light Corporation was well received. The shares have a net gain of $\frac{1}{16}$ at 32s. 6d. ex-dividend. The Corporation is to issue new shares to shareholders on bonus terms.

Palestine "A" shares dipped to 47s. 9d. before recovering to 50s. East Africans have kept steady at 32s. 6d. Tokyo 6 per cent. bonds at 86½ are well above their recent lowest price.

Manufacturing and Equipment Shares

The European situation is responsible for a fairly severe marking-down of most prices in the list of companies that manufacture electrical equipment. There was, however, at no time anything in the nature of a rush to sell shares. The market provides yet another illustration of the disproportionate effect produced by a little selling at a time when buying power is temporarily suspended. The eagerly awaited dividend announcement from Associated Electrical Industries has disappointed the optimists. Although the distribution of 8 per cent. is 2 per cent. higher than last year's, a good many people had been hoping for 10 per cent. Immediately after the announcement, the shares dipped to 42s. Buyers promptly appeared at this "bargain level," and a sharp recovery took the price to 45s. ex-dividend. The net gain on the week is 6d. Recovery in the price was assisted by the belief that, at the coming annual meeting, a very healthy condition of the company's affairs will be shown. The British Insulated Cables company also is to increase its distribution. The 15 per cent. dividend is the same as it has been for the last decade, but this year a 5 per cent. cash bonus is added. If the general dullness of the market were taken into consideration, the fact that the shares are only $\frac{1}{16}$ lower at 5, might be regarded as a sign of the market's approval. It is quite likely that, had the announcement come at a more propitious moment, a rise would have followed it. The dividend announcement by the Ericsson Telephones company failed to prevent the shares from joining in the prevailing dullness. The distribution totals 20 per cent., free of tax, against last year's 24 per cent., free of tax. A capital bonus of 25 per cent. was given, however, in September last. The shares lost half a crown at 1$\frac{1}{8}$, before recovering to 2.

The Buyer's Opportunity

In company with British Insulateds, shares in the other leading cable manufacturing companies suffered under the widespread depression. Callenders at 4 and Henleys at 7$\frac{3}{8}$ lost $\frac{1}{8}$ apiece. Enfields shed ¼ to 6¼, and Enfield Rolling Mills 1s. to 27s. General Electrics, fluctuating in sympathy with Associated Electricals, fell 1s. 6d. to 75s. 6d. before rebounding to 78s. Crompton Parkinsons lost 2s. 6d. to 65s. The market has modified its views regarding the dividend likely to be paid in the near future by the British Aluminium Company, and the shares have relapsed another 1s. 9d. to 43s. It is now thought probable that the previous year's 7½ per cent. dividend will be repeated. Telegraph Constructions and Telegraph Condensers both gave way further to 27s. 6d. and 48s. 9d. respectively. International Automatic Telephones again lost ground in spite of the announcement of a 1 per cent. increase in the dividend. The ordinary have fallen 2s. 3d. to 44s., and the deferred 1s. 6d. to the same figure. Falls of $\frac{1}{16}$ each took place in Electric Constructions and Siemens.

International Stocks

The markets on the other side of the Atlantic continue to show signs of a nervousness which is absent here. Prices at first receded further under the pressure of sales by uneasy stockholders and operators, but a return of confidence in the early part of this week brought about a measure of recovery. Brazilian Tractions relapsed afresh from 13⅜ to 12¼; then the price advanced to 13. Hydro Electrics at 8⅛, and International Holdings at 2, are lower in sympathy. Radio Corporations have lost ¼ to 12. Electric and Musical Industries are steady at 27s. 9d. The fall in Electrolux Corporations has been checked by the announcement of a good increase in trading profits. The price of the shares improved to 25¾. American Telephone and Telegraphs slipped back 5 points to 167½ before the statement of a material rise in last year's earnings helped to lift the price to 169½ ex-dividend. International "Tel. and Tel." are 16¾. Canadian Marconis at 9s. are a firm feature.

Miscellaneous Matters

The vulnerability of Cable and Wireless stocks to international disturbances is evidenced by continuation of the decline in their prices. The fall in the preference stock is limited to ⅛, but the "A" and "B" stocks shed 1¼ and ½ to 26½ and 7½ respectively. Globe Telegraphs joined in the movement, the ordinary falling ⅛ to 16 and the preference ¼ to 14. Marconi Marines receded to 33s. 9d. Disappointment with the repetition of a 12½ per cent. dividend on Revrolles is responsible for a decline in the price from 76s. to 72s. British Electric Traction deferred fluctuated violently, falling from 1450 to 1375 before jumping to 1550.

Share List of Electrical Companies

	Nom.	Dividend. 1933.	1934.	Price Mar. 17.	Rise or Fall.	Yield £ s. d. p.c.
HOME ELECTRICITY COMPANIES.						
Bournemouth and Poole	1	15	15	3$\frac{31}{32}$xd.	−1/−	3 18 8
City of London	1	7½	7½	37/6xd.	−6d.	4 0 0
Clyde Valley	1	7	8	44/-xd.	—	3 12 9
County of London	1	10½	10½	57/−	+1/−	3 13 8
Edmundson's 7% Pref.	1	7	7	36/−	—	3 17 9
Do. Ord.	1	7	8	45/−	—	3 11 1
Elec. Dis. Yorkshire	1	9	9	47/−	—	3 16 7
Elec. Fin. and Securities	1	12½	12½	3$\frac{7}{16}$	—	3 12 9
Elec. Supply Corporation	1	11	11	64/6	−$\frac{1}{16}$	3 8 3
Lancs Light and Power	1	7½	7½	38/6	−6d.	3 18 0
Lond. Assoc. Electric	1	—	—	34/-xd.	−9d.	4 2 4
London Electric	1	7	8	40/−	—	4 0 0
London Power Deb. Red.	Stock	5	5	107½	−1	4 13 0
Metropolitan	1	10	10	52/−	—	3 17 0
Midland Counties	1	7	7½	39/6	—	3 16 0
Mid. Elec. Power	1	8	8	42/6	—	3 15 3
North Eastern Electric Ordinary	1	6	6	33/-xd.	−6d.	3 12 9
Do. 7% Pref.	1	7	7	34/6xd.	−6d.	4 1 2
Northampton	1	10	10	52/6	−$\frac{1}{16}$	3 16 2
Notting Hill 6% Pref.	10	6	6	14½	—	4 2 9
North Met. Elec. Ordinary	1	10	10	58/9	—	3 8 0
Do. do. 6% Pref.	1	6	6	32/−	—	3 15 0
Scottish Power	1	8	8	2xd.	−1/−	4 0 0
South London	1	7	7	35/-xd.	+6d.	4 0 0
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	25/6xd.	+6d.	5 17 8
Yorkshire Elec.	1	8	8	46/−	—	3 9 7
PUBLIC BOARDS.						
Central Electricity, 1950–70	Stock	5	5	116	—	4 6 2
Do. 1955–75	„	5	5	119	—	4 4 0
Do. 1951–73	„	4½	4½	112	—	4 0 4
Do. 1963–93	„	—	3½	103	−1	3 8 0
London Elec. Trans. Gtd.	„	—	2½	96½	—	2 11 10
London & Home Counties, 1955–75	„	4½	4½	112	−1	4 0 4
London Passenger Transport, A...	„	—	4½	124½	−1	3 12 4
Do. do. B...	„	—	5	127	−½	3 18 9
Do. do. C...	„	3½	4	105	−1	3 16 2
West Midlands Joint Elec. 1948–68	„	—	5	116½	—	4 5 10
TELEGRAPH AND TELEPHONE.						
American Tel. & Tel.	$100	9	9	169¼xd.	−1	5 6 2
Anglo-Am. Tel. Pref.	Stock	6	6	124½	—	4 16 5
Do. Def.	„	1½	1½	29½	—	5 1 8
Cable & Wireless 5½% Pref.	„	2¾	4½	107	−½	3 17 1
Do. A. 7½% Ord.	„	Nil	Nil	26⅝	−1½	—
Do. B. Ord.	„	Nil	Nil	7⅛	−⅛	—
Globe Tel. & Tel. Ord.	10	2½	3½*	16	−½	2 3 9
Do. do. Pref.	10	6	6	14	−½	4 4 3
Great Northern Tel.	10	20	20	43	—	4 13 0
Marconi-Marine	1	10	7½	33/9	−$\frac{1}{16}$	4 9 0
Oriental Telephone Ord.	1	12	12	3½	—	3 13 10
HOME AND FOREIGN TRAMS, ETC.						
Anglo-Arg. Trams First Pref.	5	Nil	Nil	1/3	—	—
Do. do. 2nd Pref.	5	Nil	Nil	9d.	—	—
Do. do. 5% Deb.	Stock	Nil	Nil	6	—	—
British Electric Traction Df. Ord.	„	5	5	1550	+100	—
Do. do. Pref. Ord.	„	8	8	179½	—	4 19 2
Brazil Traction	100	—	—	13	−⅜	—
Brit. Columbia Elec. Rly. Pce.	Stock	5	5	99½	—	5 0 6
Mexican Light Common	100	Nil	Nil	5½	—	—
Do. 7% Pref.	100	7	7	6½	—	—
Do. 1st Bonds	$500	5	5	57½	+10	—
Victoria Falls Ord.	1	20	20	3⅜	−⅛	—
West Riding	1	5	6½	52/6xd.	+1/−	2 9 6
MANUFACTURING COMPANIES.						
Aron Electricity Ord.	1	10	15	66/3	—	4 10 7
Assoc. Elec. Ord.	1	6	8	45/-xd.	+6d.	3 11 1
Do. Pref.	1	8	8	38/−	—	4 4 3
Babcock & Wilcox	1	6	8	54/9	+3d.	2 18 5
British Aluminium Ord.	1	5	7½	43/−	−1/9	3 9 9
British Insulated Ord.	1	15	25	5	−$\frac{1}{16}$	4 0 0
Brush Ord.	Stock	Nil	Nil	42½	−1½	—
Callender's	1	15	15	4	−⅛	3 15 0
Do. 6½% Pref.	1	6½	6½	31/3	—	4 3 2
Crompton Parkinson Ord.	5/−	—	12½	65/−	−⅛	0 19 3
Do. 8% Pref.	1	8	8	38/9	—	4 2 7
Edison Swan 1st Pref.	1	7½	7½	30/−	—	5 0 0
Electric Construction	1	Nil	3½	1⅜	−$\frac{1}{16}$	2 0 0
Enfield Cable Ord.	1	25	25	6¼	−¼	4 1 8
English Electric	1	Nil	Nil	19/6	−6d.	—
Do. do. Pref.	1	Nil	Nil	22/−	−6d.	—
Ericsson Tel.	5/−	24*	20*	2	−$\frac{1}{16}$	4 0 0
Ever Ready	5/−	35	35	24/3	−3d.	7 4 4
Ferranti Pref.	1	7	7	26/3	—	5 6 8
G.E.C. Pref.	1	6½	6½	34/−	—	3 16 6
Do. Ord.	1	8	10	78/−	+1/−	2 11 3
Henleys	1	30	30	7⅜	−⅛	4 1 4
Do. 4½% Pref.	5	4½	4½	5⅜	—	3 18 3
India-Rubber Preferred	1	—	5½	1½	—	4 17 9
Johnson & Phillips	1	5	7½	46/3	—	3 4 10
Siemens Ord.	1	6½	4	27/6	−$\frac{1}{16}$	2 18 2
Telegraph Construction	£1	Nil	Nil	27/6	−$\frac{1}{16}$	—

* Dividends are paid free of Income Tax.

Published Specifications

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1934

15132. "Generators of intermittent electrical oscillations." J. Hardwick and F. Blythen. May 18th, 1934. (442938.)

18093. "Start-stop selecting and translating mechanisms for printing telegraphs and other apparatus." R. G. Griffith. June 19th, 1934. (443016.)

21055. "Lead-in conductors for transformers, switchgear, and like electrical apparatus enclosed in metal casings." H. Smethurst, F. E. Bancroft, G. Burrows, and Associated Electrical Industries, Ltd. July 18th, 1934. (443017.)

21185. "Directional wireless transmitting and receiving systems." W. S. Percival. July 19th, 1934. (443018.)

21401. "Electrical tuned circuit arrangements suitable for use in wireless signalling apparatus." Marconi's Wireless Telegraph Co., Ltd., and D. E. O'Donovan. July 21st, 1934. (443150.)

23344. "Electric invertor systems." British Thomson-Houston Co., Ltd. August 12th, 1933. (443020.)

23445. "Control apparatus for regulating transformers." Siemens Schuckertwerke Akt.-Ges., and J. W. Rissik. August 14th, 1934. (Addition to 425510.) (443152.)

23514. "Electric furnaces for melting and refining metals and other materials." T. D. Kelly. August 15th, 1934. (443099.)

23590. "Vibratory electric motors." R. Goldschmidt. August 15th, 1934. (442871.)

23701. "Electrolytic condensers." Dubilier Condenser Co. (1925), Ltd. (W. Dubilier). August 16th, 1934. (442880.)

23737. "Apparatus for charging storage batteries from a source of alternating electric current." T. A. Behrens, and Westinghouse Brake and Signal Co., Ltd. August 17th, 1934. (442883.)

23782. "Driving units incorporating an electric motor and drive-transmitting means." W. J. Tennant (American Safety Table Co., Inc.). August 17th, 1934. (442888.)

23795. "Printing-telegraph systems and apparatus." Creed & Co., Ltd., and R. D. Salmon. August 7th, 1934. (442891.)

23889. "Control of variable attenuation networks for alternating-current signalling or like systems." Telephone Manufacturing Co., Ltd., and B. J. Burridge. August 18th, 1934. (442947.)

24399. "Television and like systems, and circuit therefor." T. M. C. Lance, D. W. Pugh, and Baird Television, Ltd. August 24th, 1934. (443031.)

24424. "Method of and means for synchronising in television and like systems." T. M. C. Lance, D. W. Pugh, and Baird Television, Ltd. August 24th, 1934. (443032.)

24638. "Welding circuits." British Thomson-Houston Co., Ltd. August 26th, 1933. (443118.)

25854. "Optical illuminating arrangements for wireless receivers and the like." E. K. Cole (Radio H. Mende Ges.). September 8th, 1934. (443164.)

26256. "Radio receivers." E. K. Cole and E. J. Wyborn. September 13th, 1934. (442951.)

26366. "Tuning of thermionic valve circuits." E. K. Cole, Ltd., and G. Bradfield. September 14th, 1934. (442897.)

26614. "Permanent magnet assemblies." English Steel Corporation, Ltd., and J. C. Swan. September 17th, 1934. (442900.)

27498. "Electrically heated hot-plates." General Electric Co., Ltd., and O. W. Humphreys. September 25th, 1934. (442955.)

27790. "Radio receivers." E. K. Cole and E. J. Wyborn. September 28th, 1934. (442903.)

28471. "Mountings for dynamo electric machines." British Thomson-Houston Co., Ltd. October 4th, 1934. (442904.)

28822. "Electrically heated kettles." Price & Son (Stampers), Ltd., T. and E. E. Price. October 9th, 1934. (442957.)

29100. "Tuning indicators for wireless receiving sets." R. J. Pickard. October 11th, 1934. (443121.)

29758. "Sealing of electric conductors into vitreous envelopes." Siemens & Halske Akt.-Ges. October 25th, 1933. (442906.)

31683. "Superheterodyne receivers for television." Radio Akt.-Ges. D. S. Loewe. November 4th, 1933. (443046.)

31706. "Work holders for use in electroplating and like operations." W. Canning & Co., Ltd., and C. F. Pougher. November 5th, 1934. (442913.)

31794. "Electrical resistances and electrical heater." B. H. N. H. Hamilton. November 5th, 1934. (443170.)

32011. "High-tension electric-discharge devices." M-O Valve Co., Ltd., and B. S. Gossling. November 7th, 19134. (443171.)

33152. "Electric switchgear." G. Ellison and H. T. Stratton. November 17th, 1934. (442960.)

34173. "Indicating dials in radio apparatus." Ideal Werke Akt.-Ges. für Drahtlose Telephonie. December 9th, 1933. (443172.)

35822. "Rotary step-by-step electric switches. G. B. Seawright. December 13th, 1934. (443175.)

36293. "Electric overhead isolating switches." W. T. Henley's Telegraph Works Co., Ltd., and H. W. Breeze. December 18th, 1934. (443052.)

36430. "Cathode-ray tubes and thermo luminescent screens therefor." J. L. Baird and Baird Television, Ltd. December 19th, 1934. (442963.)

37372. "Electromagnetic relays for electric welding machines." New Process Welders, Ltd., and F. C. Hohs. December 31st, 1934. (Addition to 427328.) (332176.)

1935

1365. "Cam-driven electric switches." British Thomson-Houston Co., Ltd. January 16th, 1934. (442969.)

5794. "Electric water heating and steam generating means." J. F. G. Roberts. February 22nd, 1935. (442976.)

11870. "Electrical signalling systems." C. Lorenz Akt.-Ges. April 25th, 1934. (442986.)

14240. "Circuit arrangements for the control of electric discharge apparatus." Siemens. May 16th, 1934. (443183.)

16006. "Method of and apparatus for the conversion of electrical or mechanical oscillations into light variations." H. J. P. Von Ohain. June 2nd, 1934. (443184.)

16169. "Circuits employing multi-grid thermionic tubes." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. June 6th, 1934. (443065.)

17183. "Electric-discharge apparatus." W. Lehmann. July 24th, 1934. (443071.)

17190. "Gas circulating systems for electric arc convertors." E. Marx. June 16th, 1934. (443072.)

18464. "Anodes for electron-discharge devices." Speer Carbon Co. July 3rd, 1934. (443075.)

19188. "Magneto-electric machines." R. Bosch Akt.-Ges. July 6th, 1934. (442929.)

19315. "Magnetron tubes and arrangements incorporating the same." Telefunken Ges. für Drahtlose Telegraphie. July 5th, 1934. (443077.)

22543. "Ignition noise suppressor systems for vehicle radio receivers." Philadelphia Storage Battery Co. September 20th, 1934. (443001.)

24796. "Electric switches having arc extinguishing chambers." British Thomson-Houston Co., Ltd. September 15th, 1934. (443187.)

25560. "Electric-discharge vessels of glass." British Thomson-Houston Co., Ltd. September 15th, 1934. (443087.)

25898. "Electromagnetic clutches." Igranic Electric Co., Ltd. October 20th, 1934. (443140.)

25993. "Clockwork and other power-driven electric switches." September 28th, 1934. Landis & Gyr Akt.-Ges. (443088.)

26560. "Electric converting apparatus." British Thomson-Houston Co., Ltd. September 29th, 1934. (443189.)

28246. "Thermionic amplifiers." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. December 11th, 1934. (443191.)

28839. "Electric hand vacuum cleaners." Siemens Schuckertwerke Akt.-Ges. January 10th, 1935. (443141.)

29473. "Switch units for electrically driven domestic apparatus." Electrolux, Ltd. October 27th, 1934. (443142.)

30097. "Communication systems." General Railway Signal Co. October 31st, 1934. (443192.)

30982. "Telephone or like alternating-current systems employing variable attenuation networks." Telephone Manufacturing Co., Ltd., and B. J. Burridge. August 18th, 1934. (Divided out of 442947.) (443011.)

35140. "Electric spot welding installations." D. Sciaky. August 16th, 1933. (Divided out of 23665/34.) (443194.)

35740. "Regulating devices for electrically driven spinning and twisting machines." J. T. Shevlin (Siemens Schuckertwerke Akt.-Ges.). July 16th, 1934. (Divided out of 20798/34.) (443144.)

35974. "Mercury or other conducting liquid electric switches." Aktiebolaget H.G. Relay Patent. May 25th, 1935. (Divided out of 23300/35.) (442932.)

1936

727. "Television and like systems." J. Hardwick and F. Blythen. May 18th, 1934. (Divided out of 442938.) (443012.)

Trade Mark Applications

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from March 11th:—

Zophone. No. 565361. Class 2. A liquid disinfectant for use in connection with telephones.—Thornton & Ross, Ltd., Chemical Works, Colne Vale Road, Milnsbridge, near Huddersfield.

C.F.R. (lettering and design). No. 565907. Class 5. Copper in the form of wire, &c.—The Chile Exploration Co., New York, U.S.A. (British representatives: Cruikshank & Fairweather, 65-66, Chancery Lane, W.C.2.)

Magneon. No. 565470. Class 8. Electric neon-lamp signs.—Western Neon Signs, Ltd., 29, Wells Road, Bath.

Faratron. No. 565665. All goods in Class 11.—Watson & Sons (Electro-Medical), Ltd., Sunic House, 43-47, Parker Street, Kingsway, W.C.2.

Champion (lettering and design). No. 565565. Class 13. Sparking plugs.—The Champion Sparking Plug Co., Ltd., 83, Pall Mall, S.W.1.

Cabelite. No. 564811. Class 40. Goods manufactured from india-rubber and gutta-percha.—The Armorduct Cable Co., Ltd., 159, Westminster Bridge Road, S.E.1.

Electrical Material Inspection in Greece

Following a recent Government decree, all electrical supplies and appliances offered for sale in Greece are now subject to inspection and approval by a Committee of the Electrical Division of the Ministry of Communications in Athens, which will issue licences valid for a period of five years and renewable thereafter for successive five-year periods. Only material made by established manufacturers on a mass-production basis will be accepted for inspection and approval. Such material must bear the manufacturer's trade mark in a manner not subject to alteration or removal. The presence of the trade mark on the goods is to be regarded as a warranty that the material offered for sale is in every respect identical with the samples furnished for the inspection and approval of the committee. In the case of electric cables it is provided that, instead of the trade mark, these may bear distinctive coloured tracers. All endurance and quality tests of the submitted material and appliances are to be made in the electrical laboratory of the Ministry of Communications in Athens. Dealers in electrical equipment and supplies must arrange to obtain lists of all materials and appliances approved by the Ministry of Communications.

New Work for Contractors

Particulars of new works and building schemes for the use of electrical installation contractors and traders

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Alfreton.—Houses (30); Appleby & Ward, builders. Houses (26); Harris & Sons, builders, Marehay.

Alloa.—Houses (120), Bowhouse area; Robt. Cairns, burgh surveyor, Municipal Buildings. Extensions to Kilncraigs Factory, for Patons & Baldwins, Ltd.; John Melvin & Sons, architects and surveyors.

Alnwick.—Additions, Public Assistance institution; Guardians Committee.

Arbroath.—Houses, Guthrie Hill, and Stanley Street; T. A. Hogg, burgh surveyor, Grovesend.

Banstead.—Central school; William Moss & Sons, North Circular Road, London, N.W.2.

Barkingside (ESSEX).—Cinema, electrical work, with shops (£100,000); Kay Bros., cinema proprietors, Ilford, Barking and Becontree.

Batley.—Extensions to public library (electrical work); borough engineer.

Bexley.—Houses, East Wickham, and maternity home, Bexley Heath; G. A. Joy, U.D.C. surveyor.

Birmingham.—Extensions to factory for Buttons, Ltd.

Blackpool.—Houses, Cambray Road; G. Hodgson & Son, Ltd. Houses (25), Worcester Road; Poole & Bould. Baths, E. Wingfield-Bowles & Partners, consulting engineers.

Bourne (LINCOLNSHIRE).—Houses (44) and bungalows; J. S. Fisher, U.D.C. surveyor.

Brentford.—Extensions to Alfa-Laval Co., Ltd., Great West Road.

Brierley Hill.—Houses (26), Saltwells Wood site, Quarry Bank; U.D.C. surveyor.

Bromley.—Houses (46), New Ideal Homesteads, Ltd. Houses (84), Pickhurst Mead, for H. F. Thorburn.

Callander (PERTHSHIRE).—Houses (20); Davidson and McMichael, architects, Stirling.

Cambridge.—Rebuilding and extension of Newnham College (£100,000); Miss Elizabeth Scott, architect, 3, St. George's Terrace, Regent's Park, London, N.W.1.

Canvey Island.—Bathing pool, with offices, kiosks, &c.; C. R. Butcher, U.D.C. surveyor.

Cardiff.—Houses (46), Ely (Degar Field); town clerk, City Hall. Motor and aeroplane showrooms, Aerodrome; A. S. Davies.

Caterham.—Houses (26), Stafford Road; C. H. Harrington.

Cheshire.—Police quarters, Sandiway, and welfare centre, Runcorn; county architect. Schools, Rudheath (£28,400), and Sale (£33,000), for County E.C.

Coventry.—Church, Holyhead Road, for the Unitarian trustees; Rev. Richard Lee, pastor.

Croydon.—Cinema, Norbury, electrical work; Douglas Harrington, architect, Craven Street, Charing Cross, London, W.C.2.

Darlaston.—Cinema, Pinfold Street, for D. & D. Cinemas, Ltd.; Ernest S. Roberts, architect, Birmingham.

Devonshire.—Senior schools, Braunton, Chulmleigh, Dawlish and Exmouth, for County E.C.; H. V. de Courcy Hague, county architect, 97, Heavitree Road, Exeter.

Didsbury.—Houses (306), Lindbury estate; Amalgamated Building Co., builders, Queen's Buildings, St. Peter's Square, Stockport.

Dorset.—Extensions to Dorchester Institution; county architect.

Eccles.—Aluminium foundry for L. Gardner & Sons, Ltd., engineers, Patricroft.

Essex.—County High School for Girls, Hornchurch (£47,296), for County E.C.

Folkestone.—Bathing pool, &c., electrical work (£30,000); T. H. Mawson & Son, architects, Lancaster. Entertainment hall, restaurant, &c. (£40,000), Victoria Pier; D. F. Warren, managing director of Ramsgate Olympia, Ltd.

Gateshead-on-Tyne.—Houses (34), Kyle Road, for the Church Army, 55, Bryanston Street, London, W.1.

Gillingham (KENT).—Houses (36), for A. E. Clifford.

Halsall (LANCASHIRE).—Factory for S.N.C., Products, Birkdale.

Harrogate.—Cinema, Cambridge Road and Oxford Street; Associated British Cinemas, Ltd., 30, Golden Square, London, W.1.

Harrow.—Civic buildings; V. O. Rees, 33, Bedford Place, London, W.C.1.

Helsby.—Hotel (£15,000), for Greenall, Whitley & Co., Ltd.; Mr. Wright, architect, Warrington.

Hemsworth (YORKSHIRE).—Houses (28); R. K. Poskett, Beal, builder. Houses (28); Gibson Bros., builders, Upton.

Herne Bay.—Cinema, for Odeon Cinemas, Ltd.

High Monkseaton.—Hotel, Earsdon Road and Grange Park (£15,000); Northumberland Hotels, Ltd.

Irvine.—Houses, Kilwinning Road and Springbank, Ayr Road; W. L. Weir, burgh surveyor, Town House, Irvine.

Kent.—Premises for Simon Langton girls' school, Canterbury; county architect.

Kidderminster.—Houses (31), near Greatfield Road, for Hughes & Son. Houses (30), for Painter & Talbot. Houses (24), for W. B. Whittingslow.

Lancashire.—Mental hospital, Lathom Park, Ormskirk (£1,100,000), for the County Mental Hospital Board; Sir George Etherton, clerk, Preston.

Lanchester (Co. DURHAM).—Cinema, Langley Park, for the Zymo Cinema Co.; William Dunn, builder, "Foxcote," Ferryhill.

Leadgate (Co. DURHAM).—Houses (100); U.D.C. surveyor.

Leeds.—Cinema, for the Monseigneur News Theatres, Ltd., 215, Piccadilly, London, W.1.

London.—(BETHNAL GREEN).—Schools, Portman Place and Morpeth Street (£92,171); L.C.C. architect. (CATFORD).—Houses (145), Whitefoot Lane; Wates (Streatham), Ltd., 98, London Road, Mitcham. (CHARING CROSS).—Rebuilding Charing Cross Hospital, Adelphi site; governors. (HIGHGATE).—Premises for William Ellis School (£53,017); C. Miskin & Sons, Ltd., Barons Court Road, W.14. (HOLBORN, E.C.1.).—Reconstruction of Smithfield institute (£45,450); L.C.C. architect. (KENSINGTON).—Shops and flats, 182-4, Fulham Road; Gale, Heath & Sneath, 15, New Bridge Street, E.C.4. (ST. MARYLEBONE).—Offices and flats, Marylebone Road; J. Stanley Beard & Bennett, 101, Baker Street, W.1.

Malden (SURREY).—Stores, Malden Road, for F. W. Woolworth & Co., Ltd., 1, New Bond Street, London, W.1.

Manchester.—Houses (46), Clough Road, Blackley; Broughton Atkinson & Eagle, architects, 37, Brown Street, Manchester. Houses (36), Glenbrook Road, Blackley; J. Saxon, builder, 27, Brooklands Road, Crumpsall, Manchester. Houses (36), Hazeldene Road, New Morton, for A. Hogg, 70, Crumpsall Lane; Roberts & Wood, architects, 26, King Street. Houses (136), Wood Road, Baguley; Beccles Wood Estate Co., Ltd., Wood Road, Framingham Road, Sale. Cinema, East Lancashire Road and Henniker Street, Swinton, for the Ellesmere Super Cinema Co., Ltd., 13, St. Ann Street; Thos. Collier & Sons, builders, Brown Street Works, Leigh.

Mansfield.—Houses (63), Racecourse estate; W. Thompson, borough engineer.

Melksham.—Dried milk factory, Thurnhold, for the Co-operative Wholesale Society, Ltd.; C.W.S. architect, Balloon Street, Manchester.

Middlesbrough.—Garage, Newport Road (£25,000); United Automobile Services, Ltd., Grange Road, Darlington.

Middlewich.—Works, for J. Steventon & Co., Ltd., Royal Pottery Works, Burslem.

Morayshire.—Single span steel girder bridge (£37,500) over Findhorn, near Forres; county clerk.

Morecambe.—Promenade improvements (£50,000); General Purposes Committee.

Newcastle-on-Tyne.—Preserving factory, Brinkburn Street, for J. Lowrie; J. N. Fatkin, architect, 17, Bigg Market, Newcastle-on-Tyne.

Nottingham.—Nurses' home and training school, for the City Hospital, Hucknall Road; city engineer.

Oakengates (SHROPSHIRE).—Houses (50); U.D.C. surveyor.

Oldbury.—Houses, Titford, and Pencricket; U.D.C. surveyor.

Orpington (KENT).—Cinema, Petts Wood, electrical work, for Shipman & King, Charing Cross Road, London, W.C.2.

Penrith.—Premises, Middlegate; M. Burton, Ltd., 113-132, New Oxford Street, London, W.C.1.

Peterborough.—Cinema, Odeon Theatres, Ltd., 7, Park Lane, London, W.1.

Portsmouth.—Baths, Hilsea (£34,216), with engineering services; borough engineer.

Rotherham.—Houses (194), Gilberthorpe Street; Hall & Jenkinson.

St. Helens (LANCASHIRE).—Hotel, Sutton; Williams & Co., architects, Hall Street.

Salford.—Cinema, café, &c., electrical work, Broad Street. Pendleton; George Tonge, architect, Southport.

Sandwich.—Houses (50), Woodnesborough Road, for W. & H. Properties, Ltd.

Scarborough.—Hotel, Esplanade Gardens, for the Brooklands Hotel Co.; Jones & Rickaby, architects, 102, Westborough.

Sheffield.—Pea canning factory, Wadsley Bridge (£100,000) for Batchelor & Co. (Sheffield), Ltd.; S. N. Cooke, architect, Sun Buildings, Bennets Hill, Birmingham.

Southport.—Extension to Technical College, for E.C.

Stockport.—Houses and flats (£30,530); Thomas Davies & Sons, builders.

Stockton-on-Tees.—Houses (70), Colchester Road, &c., for H. Cohen, "Engadine," Hartburn, and additions to Stockton Grammar School; G. P. Stainsby, architect, 25, High Street.

Stoke-on-Trent.—Girls' secondary school (525 places), Thistley Hough, Penkhull; city architect.

Stourport.—Houses (34), Burlish, for P. Hall & Son.

Sunderland.—Houses (35), Dacre Road; W. Rutherford, builder, Sea Road. Houses (92), St. Aidan's estate; J. and T. Parker, Ltd., builders, St. Oswald's House, Sunderland.

Surrey.—Completion of County Hall, Kingston-on-Thames (£146,000), and technical college, Guildford (£120,000); county architect. Technical college, Raynes Park, for C.C.

Swansea.—Houses (234), Galligrafog estate; borough architect. Houses (18), Harlech Crescent; T. & G. Spragg. Showrooms and offices, Mansel Street; W. & R. Cook, Ltd.

Wallasey.—Sports Palace (£250,000); E. Berry Webber, 39, Golden Square, London, W.C.1.

Walthamstow.—Cinema, Hoe Street, electrical work; A. Mather, architect, John Street, London, W.C.1.

Watchet.—Houses (38), South View, for H. V. Geen Williams.

West Hartlepool.—Cinema, Hart Road, for T. H. Pailor (£40,000); W. Pearson & Son, builders, Burn Road, West Hartlepool.

West Riding.—Secondary school, Adwick-le-Street (£40,975), and senior school, Stainforth (£20,600), for County E.C.; education architect, Wakefield.

West Sussex.—Senior school, Selsey, and alterations and additions to Chichester Boys' Secondary School (£13,375), for County E.C.

Whitby.—Cinema, Upgang Lane, Whitby; A. N. Palframan, builder, Upgang Lane.

Wythenshawe.—Factory, for J. B. Hyde & Co., Broadheath.

Yeovil (SOMERSET).—Cinema, for Odeon Cinema Circuit, Birmingham.